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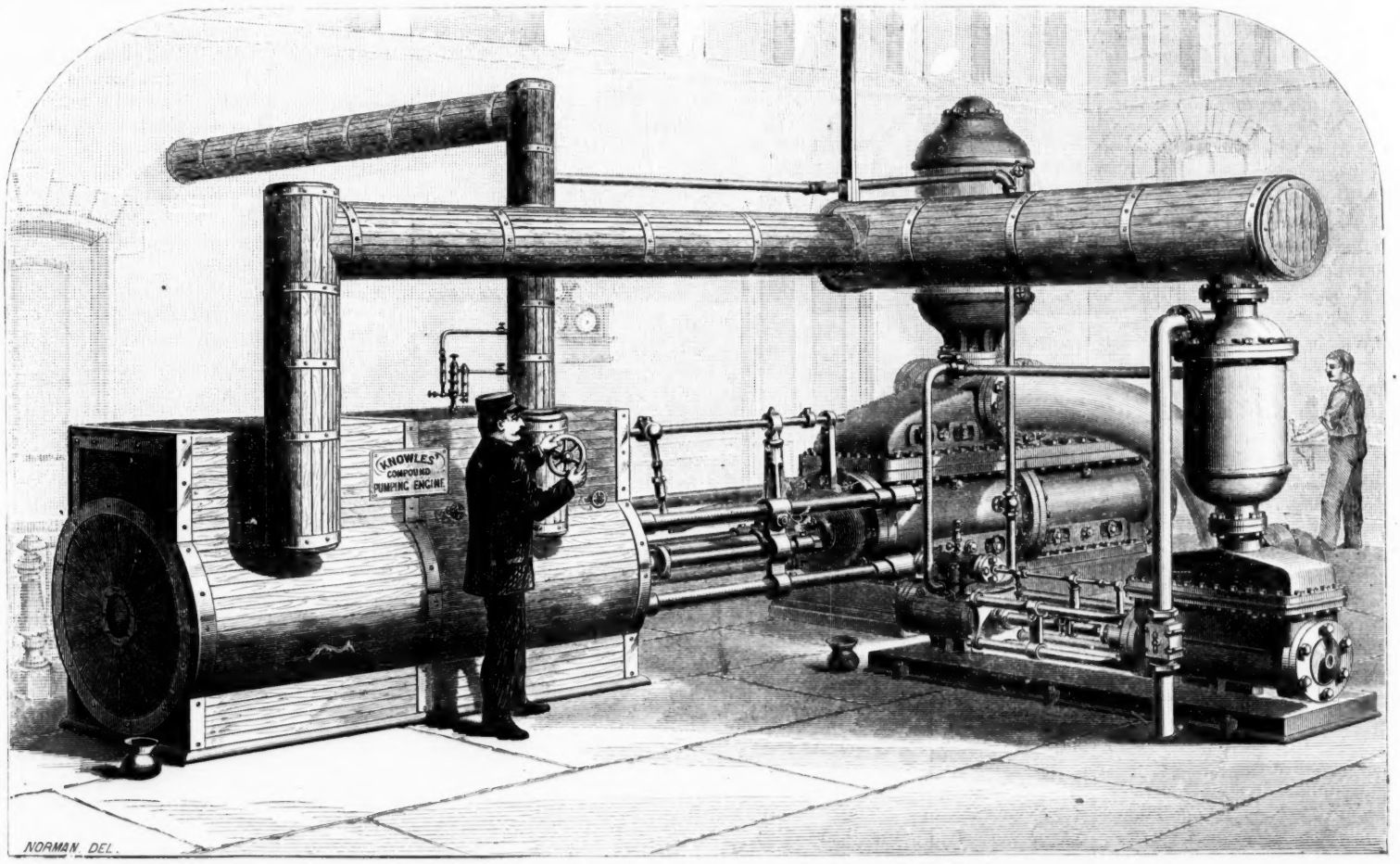
Improved Compound Pumping Engine.

The designing and building of water-works pumping engines, which shall be not only economical in their first cost, but also in expense of maintenance, calls forth the highest engineering ability. One of the latest designs that have been carried out into practical use, is the Knowles' Improved Compound Pumping Engine, an engraving of which is shown upon this page, which gives a general idea of the machine. Its dimensions are as follows: High pressure cylinder, 20 inches diameter; low pressure cylinder, 38 inches diameter; water cylinder, 20 inches diameter; stroke, 36 inches; capacity, when running at average speed, 2,000,000 gallons of water per day. There are many of these pumping engines in operation at different pumping stations, among which may be mentioned the Chicago, Charleston, S.C., and Newport, R. I., Water Works. This apparatus is claimed by its makers to combine in its design and construction the advantageous features possessed by other machines of its class, as well as peculiar merits of its own.

With this engine there is no jar or concussion in pumping, an annoyance that is commonly met with in most grades of pumping machinery; the water passages are direct and roomy, the valve openings have large area and the pump gives excellent results at the extreme ranges of speed and pressure. It will be noticed that the air pump is not connected to the engine, but forms, with the condenser, a symmetrical and well-designed independent apparatus. The advantage of this arrangement is that the vacuum can be secured before the pumping engine is started. It is also more economical in the use of steam than if connected, as its speed can be correctly adjusted to the requirements of the main engine.

The valve motion is the same as that upon the improved style of Knowles' pumps, so well known. The engine is compact, simple and well built. It is built by the Knowles Steam Pump Works, New York and Boston.

The prospects for general machinery business for 1881 are very flattering.



KNOWLES' IMPROVED COMPOUND PUMPING ENGINE.

Extracts from Chordal's Letters.

WEAK POINTS IN SOME SHAFT COUPLINGS. —BORING AND FITTING SPLIT PULLEYS.— PECULIARITIES OF SEGMENTAL PACKINGS. —THE DISCIPLINE OF FAILURES.

Mr. Editor:

* * * * I see by *Easy Way's* letter, in one of your late issues, that my elegant plan of fitting up couplings has not escaped criticism; I should blush for my countrymen if it had. I think your readers are under obligations to me for being the cause of *Easy Way's* letter. I believe, between the two letters, there should be some discussion on the coupling subject.

* * * * The "easy way" is the most sensible war cry which could be suggested for a shop. Other things being equal, the easiest way is the best way. An easy way, in any process, will permit better and more accurate work.

* * * * The Fig. 2 coupling used by *Easy Way*, must be used by some one having an interest in its good behavior before it will act well. I have used them and could get no satisfaction out of them. The fault I find with them is that they won't stay on a shaft; they won't hold; "they have no vice." I have fitted up such a coupling, and put a pin clear through coupling, shaft and all, and had the thing chew the pin right off. Of course, the shaft was not in line. Any kind of a coupling would answer tolerably well, if a shaft was in perfect shape.

* * * * I do not think any coupling will do well which has but one-sized bore to fit two sizes of shaft. I never found any process for getting the two shafts of the same size. My leaning has always been towards those clamp couplings which take an independent grip on each shaft, and have some effective combination of the mechanical powers to enforce the gripping intention.

* * * * Flange couplings keyed on shafts, no matter how good the fits are, are bound to be eccentric with the shafts, therefore, they cannot be utilized as a centering device. The tit-and-socket arrangement makes the shaft self-centering, independent of any exterior devices. If one cares to secure real concentricity, the pin-and socket is the "easy way."

* * * * Will some one kindly explain to me why coupling bolts should fit in their holes? I claim that such fits damage a coupling by tending, in case of even the finest workmanship, to destroy all the nice concentricity of the two couplings. They are expensive to fit up, are hard to get in and out, are liable to destruction in removal, etc., and are liable to upset burrs in the holes while being driven in. If the bolts were to act as dowels, they should fit. They are not for dowels, and if fitted tightly only tend to interfere with the function of the real doweling features.

* * * * I once overhauled a lot of old mill work, and found that all the shafting, large and small, was provided with simple screw couplings. A two-inch shaft, for instance, would have an eight-thread screw cut, say, five inches, on the end. The coupling would be simply a sleeve with a thread in it, and a lock nut of same diameter, would be provided at each end. There were holes for a spanner. I never before, or since, saw couplings of this kind, and I have often wondered if they were good. They were so neat, and simple, and cheap, all being lathe work, and smooth and innocent looking generally, that they possessed a charm for me.

I never made any like them, because I argued that they must be a fraud or they would have been common. Of course, a shaft thus fitted could run in but one direction, but I don't see that that is a defect for line-shaft work. These elegant-looking couplings cross my memory every once in a while, and if some one who has had experience with them will rise and explain, I, for one, will be ever so much obliged.

* * * * A coupling split through the bore suggests other holes made in two pieces, and makes me wonder why a lathesman can't bore such a thing to fit. It seems as if a lathesman took special delight in making all cut fits too loose or too tight. Give a man a split pulley to bore, and he will bore it too small for the shaft. He ap

pears to think that there is something compensating or corrective about split fits, when in reality such fits require the same care and accuracy as other fits.

I really believe that the average lathesman, when he has a split hole to bore, wonders which he ought to make it: too large or too small.

* * * * I at one time had much to do with segmental packing, and I found that not one lathesman in a hundred would turn the rings to fit a cylinder. He might use the utmost care to have the spider or the follower fit, but might not care whether the rings fit or not.

With segmental packing, most men will turn the rings too large to go into the cylinder. They do this, I suppose, for fear they will get them too small. A ring larger than a cylinder will never fit the cylinder when cut into pieces. It is true they can be got into the cylinder after being cut up, but so could they be got into a shot gun, if they were cut up fine enough.

* * * * The safe side of a piston fit is the small side. Expanding devices will tend to make a small ring fit nicer, but will have no good effect on rings turned too large for the cylinder. A safe rule on all piston work is to put the things clear through the cylinder before they are cut. If they won't go through they are too big. This rule applies to every form of piston ring. Even those rings which are intended to spring out of their own accord and fill the cylinder should be turned to fit, and after they are cut they may be opened out by piening or by expanding them on a lathe chuck.

* * * * There is a fearful sight of prejudice in the art of making pistons. I have known men to scrape and grind a day on common three-ring packing, the intention being to keep steam from going past the edges of the rings, when at the same time the saw-cuts, and the rough fit of the inside ring in the outside ones, made a crack so large that water would run out faster than it could be poured in at a half-inch hole bored through the follower. I have tried this thing to settle bets more than once.

I have seen spring packing worked on for a day with scrapers and emery *before the rings were cut.* I have seen such rings spring a sixteenth sideways after being cut. I have seen a bold man get the rings out in fair shape, then cut them, and then put them back in the lathe and face them up, making a tiptop job of them with very little work. I have tried this latter plan myself two or three times and have in each case made a most inglorious failure of it.

* * * * My failure to do this work reminds me of lots of things which I have failed on, and which some other fellow working right alongside of me would do with ease. I always considered myself the best machinist that ever lived, and when I heard of big wages being paid in some distant shop, I assumed, as a matter of course, that all I had to do was to go to that shop and get a job. When I got the job I didn't always get the big pay, but I was too smart to kick much about it. My career as a journeyman machinist was rendered much smoother and more pleasant than usual, by my having come to a knowledge one day that I could find better mechanics than myself in every shop I went into. This was a bitter pill, but I swallowed it and it did me good.

I could tell some interesting things regarding my own experience and the experience of others, who, like myself, were troubled with the big head for some time before discovering the proper remedy. I know one man to-day who never got more than a dollar and a half a day in his life, and he never was worth any more either, and still that man will tramp from the Atlantic to the Pacific ocean if he hears that *good* machinists out there are getting two or three dollars a day. He can tell of the many times he has been humbugged by shop owners, and I can tell of many a poor shop owner who has been humbugged by him. He has tramped this country over expecting to find a man foolish enough to pay him the wages of a good machinist, and I never knew him to work a day for less than he was actually worth when compared with other men.

* * * * Very respectfully,

CHORDAL.

New Shaping Machine, and Gear Cutting Machine.

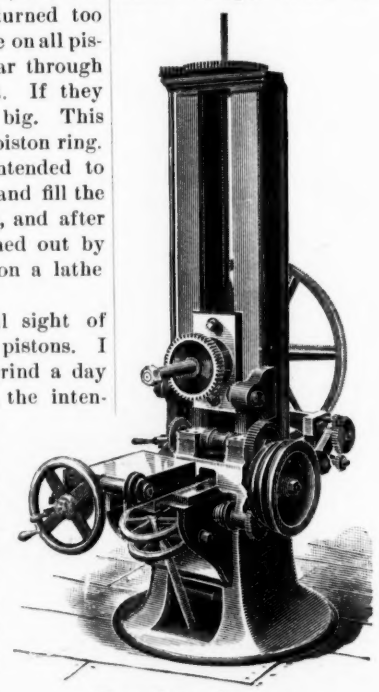
One engraving shown herewith represents an improved shaping machine which possesses some new and meritorious features, as will be understood by an inspection of the engraving and the following description:

The machine is of strong and substantial design. The stanchion which takes the entire thrust of the ram, and upon which the accuracy of the machine so largely depends, is strong and sufficiently well braced to meet all requirements.

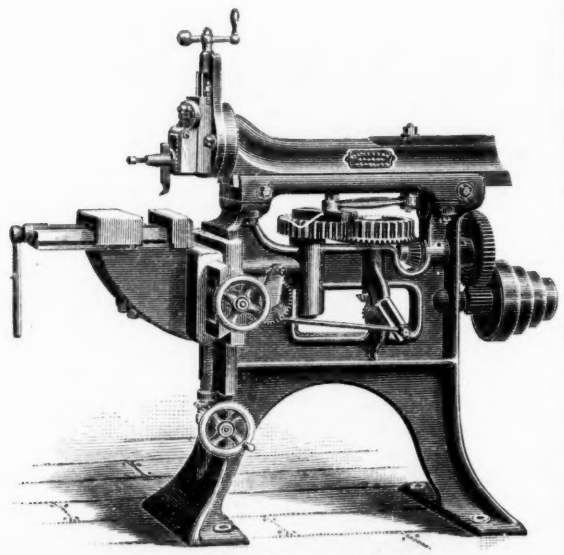
A common error into which many toolbuilders have fallen is, that of striving to make a shaper which will perform all the functions of a planer. To secure this result the length of the stroke has been gradually increased, until the efficiency and accuracy of the tool has been seriously impaired. It is an impossibility for a shaping machine, built as lightly as many of them are, to plane smoothly, or with any degree of accuracy, when nearly 50 per cent. of the ram is outside the stanchion. These extremes should be carefully avoided, and the true adaptation of the shaper kept in mind. The true object of a shaper is to do the work of a small planer expeditiously as well as a constant assistant to the vise hand. These ends have been kept in view by the designer of the shaper shown in the engraving. It has a table and vise, also a stroke of 9″, and a cross motion of 18″. The table can be elevated or lowered 9″. The tool box has a vertical motion of 6″. The return stroke has three times the velocity of the forward stroke, this motion being secured by a pair of elliptical gears. The stroke may be altered from 0 to 9″ by means of a slotted crank cast upon the elliptical gear. The cross feed is automatic, and is changed from fine to coarse by a variable crank motion. All screws are made of steel and all surfaces broad and scraped to a perfect bearing. The lost motion in the fiddle and cross head is taken up by means of taper wedges, with a screw adjustment. Full set of wrenches, counter shaft, hangers and pulleys, are furnished with each machine. The largest size of this style of machine has a stroke of 16″, and is especially calculated for railroad shops and other heavy work.

A gear-cutting machine is shown by the other engraving. The manufacturers of this machine have entirely remodeled their gear cutters, as made some years ago, and to meet the wants of establishments requiring such tools. They are now making two sizes of the improved machines, the smallest one having a capacity to cut any gear from one inch to 48″ in diameter and a 5″ face, and the largest one from 1″ to 84″ diameter and a 10″ face. The cutter carriage, as will be observed, is swung from a fulcrum upon the stanchion, and can be tilted by means of an adjustable screw underneath to cut gears of any required angle. The carriage also has an automatic friction feed with three changes of speed, secured by grooved cone pulleys. An automatic stop motion is attached, which is so arranged as to give a feed of any required length from 0 to the full capacity of the machine.

The worm-dividing wheel is laid out with mathematical accuracy by a standard dividing machine, and is made in halves. In the process of finishing with a worm milling tool the relative position of the sections is repeatedly changed, and the teeth remilled after each change, until all inaccuracies in the pitch are practically eliminated, thus securing the greatest perfection in this vital feature of a gear cutter. The screws and spindles are all made of best cast steel. All journals are large and well fitted, and sliding surfaces broad and scraped to a perfect bearing. A proper complement of change gears, to cut a large range of pitches, is furnished with each machine; also counter shaft, pulleys and hangers, also a full set of case-hardened wrenches. A tightener with weight is provided to keep a constant and proper tension of belt.



NEW GEAR CUTTER.



NEW SHAPING MACHINE.

These machines are made by the Hewes & Phillips Iron Works, Newark, N. J. E. P. Bullard, Agent, 14 Dey street, N. Y.

The success of the new Thomas-Gilchrist process for dephosphorizing steel threatens to revolutionize that manufacture. The Bessemer process requires ores of a high grade, such as are found in only a few places. But the successful working of the new converters built by Bolckow, Vaughan & Co. proves, it is said, that ingot steel of exceptional purity can be made from the commonest Cleveland pig. The process is cheap and simple. The blast is made, the furnaces tapped, the melted ore put through the Bessemer converter, fluxed and blown, and in twenty minutes is run into large ingots, rolled, cut and drilled—steel rails of the best quality. Samples of these rails, taken at random, are said to have showed 2.100 less phosphorus than the best rails made at Barrow-in-Furness, of the superior red hematite ore found there.—*Railway Age*

The Springfield and Memphis Railroad Company has been incorporated in Arkansas to build a railroad from the Missouri State line in Sharp County, Ark., southeast to a point on the Mississippi, opposite Memphis. The distance is about 165 miles, and the capital stock is to be $3,000,000.

There is talk of erecting a jute factory and bagassee paper mill near Gretna, La.

COTTON-SEED HULLS FOR PACKING JOURNAL BOXES.—The use of cotton-seed hulls as a substitute for cotton waste for packing the journal boxes of cars and locomotives, says the *Railway Review*, seems to have passed beyond the experimental stage and to have become an established success. It is now in use on several roads with most satisfactory results, and others are preparing to adopt it. It is claimed that the hulls are actually superior to ordinary cotton waste for packing, and would be preferable at the same cost. But the cheapest cotton waste is now worth 7½ cents a pound, and the superior grades range as high as 14 cents. Cotton-seed hulls can be delivered in any part of the United States at *one cent* a pound. As a measure of economy, this subject is worthy of the attention of all railway officials.

Rubber cushions under the legs of a work bench are suggested as an effective method of deadening noise, it being found, as stated, that in a certain factory the hammering of fifty coppersmiths was scarcely audible in the room below, their benches having under each leg a rubber cushion. Kegs of sand or sawdust, applied in the same way, afford similar immunity. A few inches of sand or sawdust being first poured into each keg, there is laid on it a board or block, upon which the leg rests, and around the leg and block is poured fine dry sand or sawdust. By this simple means, it is said, not only all noise, but all vibration and shock are so completely prevented that an ordinary anvil thus mounted, may be used even in a dwelling house without annoying its occupants.

The largest crane in the world is nearing completion at the Woolwich Arsenal. Two thousand tons of iron are employed in its construction and it covers a quarter of an acre. Four years have been occupied in putting the monster machine together. When finished, it is expected that it will be able to lift four 100-ton pins, and one man can easily work it.

About the best new departure in railway regulations that has lately come to public attention is the order of Mr. Wm. H. Vanderbilt prohibiting the sale of all "flash literature" on all trains and in all depots under his control. It is bad enough to see this class of printed matter ostentatiously displayed on street news stands, where there is a large demand for the unhealthy trash, without having it unwillingly thrust under our noses whenever traveling on a railroad train. Let other railroad managers follow his example.

The *Locomotive* publishes engravings in each issue showing how boilers look just after they have exploded. This doesn't seem to hit the case at all. What is needed is a picture showing how a boiler looks just before it is going to explode. We would then learn when to get out of the way.—*New Haven Register*.

In 1870 the various manufacturing establishments in New Orleans gave employment to 5,640 persons, and produced $9,980,278 worth of articles. In 1880 the number of persons employed was 10,977, and the product worth $20,909,047. This is an increase of nearly 100 per cent. in the number of employes, and more than 100 per cent. in the product.

The machinery department at the Melbourne International Exhibition was far from being as complete as could be desired, at last accounts, especially the American and the British sections. The most that was in position from this country was a collection of harvesters and agricultural machines of different kinds. The most prominent objects in the British machinery section are hydraulic machines and gas engines. Many machinery manufacturers seem to have been apprehensive that their designs would be copied, and were, therefore, not inclined to place their most improved productions on exhibition.

Lighting Broadway, New York, with the Brush Electric System.

The interest manifested in the subject of lighting by electricity becomes more apparent as successive developments have been made, each being more successful than those that have preceded it. At the present time it is an apparent fact that the electric light is to be the light of the future.

Only a few years since it was generally believed that it was impossible to perform work in factories at night as accurately and with the same dispatch as in the day time; neither was it thought possible to continue the work of construction upon buildings or to load and unload vessels after dark. But the introduction of the electric light has resulted, metaphorically speaking, in turning night into day, so that by employing a double force of men or women, as much work can be done at night and equally as well as in the day time.

A few months ago it was announced that the Brush Electric Light Company, of New York, had been organized for the purpose of introducing the electric light into this city for lighting the streets, parks, and large buildings. That company has not been idle during the intervening time, but has located the first station and put down the first plant at 133 and 135 West Twenty-Fifth street. First, there is a Corliss engine in operation, built by Watts, Campbell & Co. The foundation has been arranged for the reception of a pair of 18″x42″ engines, to be connected to the same shaft, only one of these engines being now in place. The engine now running is rated at 100 horse power, but can be worked up to 125 horse power. The fly wheel is 16 feet in diameter, has a 32″ face, runs at a speed of 80 revolutions per minute, and weighs 25,000 pounds. The main belt is 71 feet long and 30″ wide. This belt makes a speed of a little upwards of 4,000 feet per minute. The boilers for furnishing steam to drive the engines are of the horizontal tubular style, the shells being 16 feet long and 5½ feet in diameter. The upper half of the shells are made of iron, while the lower half is of steel. Each boiler has 92 tubes 3″ in diameter, and they are set according to the Jarvis system, with special improvements by Charles A. Berton, the furnaces being arranged for burning coal dust, composed of about one part of bituminous coal to ten parts dust.

The feed water is supplied by a No. 5 Deane steam pump, and passing through a Strong heater 36″ in diameter and 12 feet long frees it from all scale producing constituents.

The whole plant has been devised and constructed under the supervision of Mr. W. H. McGrath, the engineer of the company. His object is to obtain power at the lowest possible cost, and the result will be watched with interest.

There will be two circuits connected with this station, which are to be supplied by five Brush dynamo-electric machines. One of these circuits is to be used exclusively for lighting parks and streets, while the other is for miscellaneous lighting, such as hotels, stores, and other buildings, it being found best not to confound the public with the private lighting.

A No. 7 Brush dynamo-electric machine is represented in one of the accompanying engravings.

This machine is 68″ long, 30″ wide, 30″ high, and weighs 2,500 pounds. The pulley is 14″ in diameter, having a 9″ face, intended for a belt 8″ wide, which will drive the machine from 750 to 800 revolutions per minute. It is calculated to supply 10 to 18 lights, and requires 14 horse power to drive it. A larger machine (a No. 8) is now being built, which is 8 feet long, and of the same style as No. 7. When finished, it is intended to run 40 lights, requiring an expenditure of from 30 to 35 horse power.

The power here mentioned is calculated to run these machines to their full capacity, causing each lamp to furnish a light equal to that of 2,000 candles.

The territory controlled by the company extends from 14th St. (Union Square), to 34th St, and from Third Ave. to Eighth Ave. The first practical electric lighting of streets in this city is upon Broadway, extending from 14th to 34th Sts. Within these limits there are 22 lamps, one upon each block. The lamps are mounted upon iron posts of a neat and ornamental design, and 25 feet high, each lamp giving, as stated, a light of 2,000 candle power.

The construction of the lamps will be better understood by referring to the engraving, in which Fig. 1 represents a No. 3, or double lamp. This lamp is fitted with two carbon rods, arranged so that when one set of the carbons is consumed, the second set is switched into the circuit, burning until they are consumed. This is done without any interruption whatever to the light. The lamp will burn from fourteen to sixteen hours without attention.

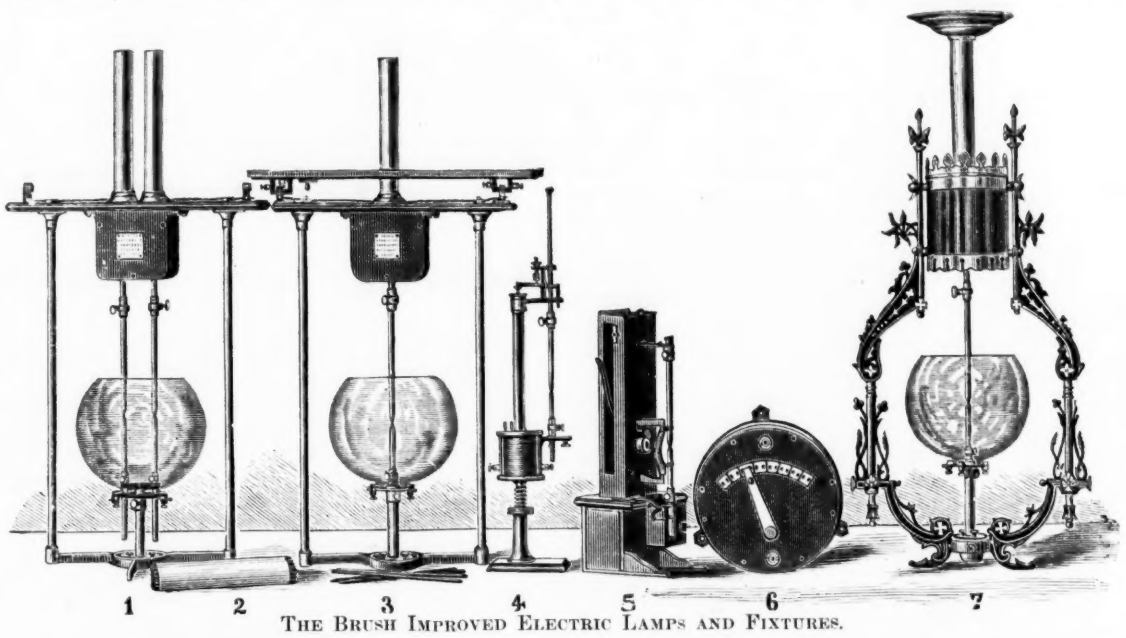
A bundle of carbons is represented by Fig. 2 ready for transportation, while Fig. 3 shows a No. 2, or single lamp, similar in construction to Fig. 1, but having only one set of carbons. This lamp burns from seven to eight hours without attention. The lamps are all very simple in their construction, the mechanism insuring safety of management and regularity of operation. The double magnet circuit conveys the currents in opposite directions, by means of which any number of lamps may be operated in a single circuit without any irregularity of action.

The short circulating safety attachment, by which any lamp offering an abnormaly great resistance in consequence of the final consumption of its carbons, or other cause, will, without any change of strength in the main current, automatically short-circuit the said lamp and thus preserve the general circuit. A multiple set of carbons, burning successively without the intervention of any switching or other special mechanism, secures the maintenance of the light for any desirable length of time without requiring attention or adjustment by the attendant other than placing the carbons.

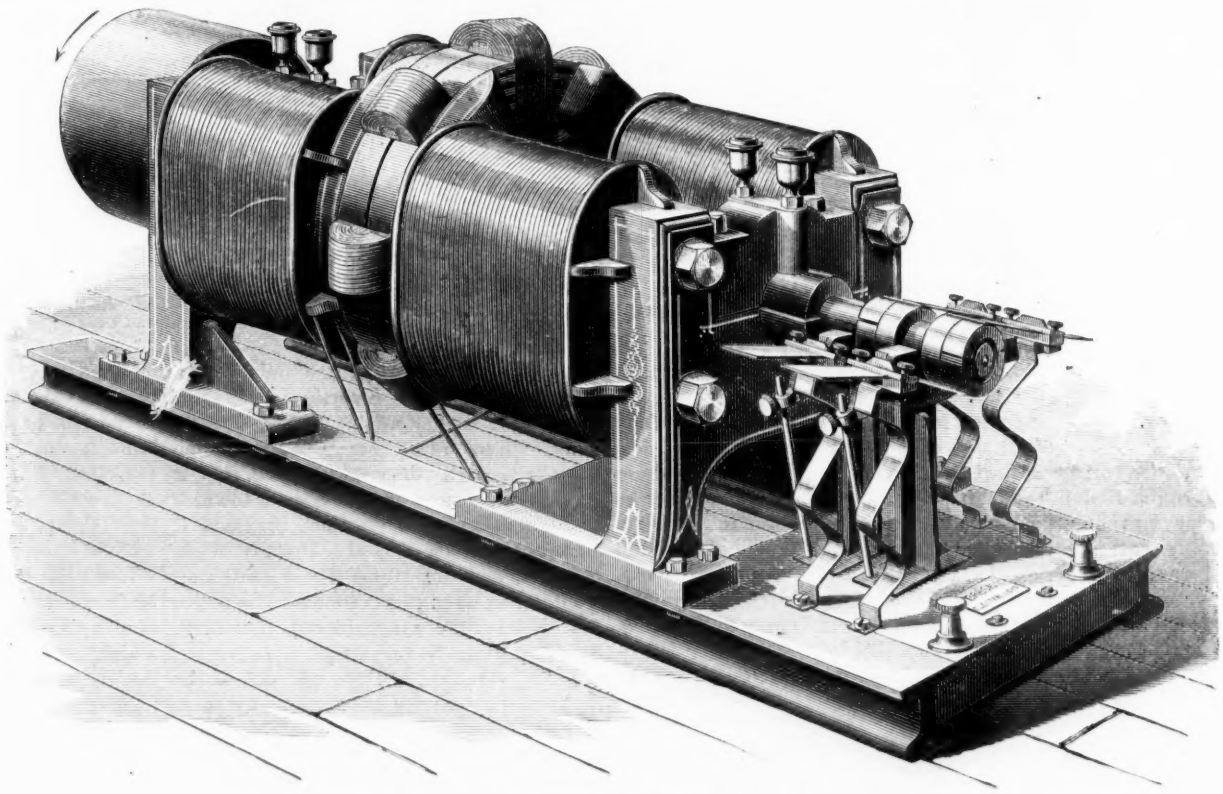
These lamps contain no clock-work or similar mechanism of any kind. The movement of the upper carbon actuated by gravity is controlled by a simple annular clamp which surrounds the rod carrying the carbon. When the lamp is in operation one side of this clamp is lifted by magnetic action, which causes it to grasp and raise the rod, and this separates the carbons. As the carbons burn away, the magnetic action diminishes, and the clamp and rod move downward, maintaining only a proper separation of the carbons. But when the tilted annular clamp finally touches the supporting floor from which it started, any further downward movement will at once release the rod, and allow it to slide through the clamp until the latter is again brought into action by the increased magnetism due to the shortened arc between the carbons. In continued operation the normal position of the clamp is in contact with its lower support; the office of the controlling magnet being to regulate the sliding of the rod through it. If, however, the rod slides too far, it will instantly and automatically be raised again, as at first, and the carbon points thus maintained in proper relation to each other.

A focussing lamp, intended for projections in magic lanterns or other similar apparatus, is shown in Fig, 4 of the engraving; and Fig. 5 represents a lamp intended for application to the reflectors of locomotive head lights, or for steamers. An ornamental lamp is shown in Fig. 7, adapted to use in hotels, stores, and other places where a showy lamp is needed. This lamp can be made either single or double, as desired.

A regulating switch or dial attachment is shown in Fig. 6. It is intended for use in connection with the largest machines, and is so arranged that any number of lights—from one up to the full number—may be burned without varying the speed of the machine.



THE BRUSH IMPROVED ELECTRIC LAMPS AND FIXTURES.


THE BRUSH IMPROVED DYNAMO-ELECTRIC MACHINE.

This first introduction of the Brush electric light into the metropolis for street lighting, is only repeating here what has been done in other cities on this continent.

The longest circuit that we have known for electric lighting is in Montreal, O., where one of the Brush machines works a circuit of 14,600 feet, or nearly two and three-quarter miles in length. The plant is on the wharves, and the lights illuminate the harbor, so that vessels can change their positions; also load and unload their cargoes as well at night as in the daytime. The invention is an entire success in this instance. In the Grand Pacific Hotel, Chicago 570 gas jets have been replaced by 17 electric lights, which, according to the statement of the proprietors, effects a saving of $300 per month.

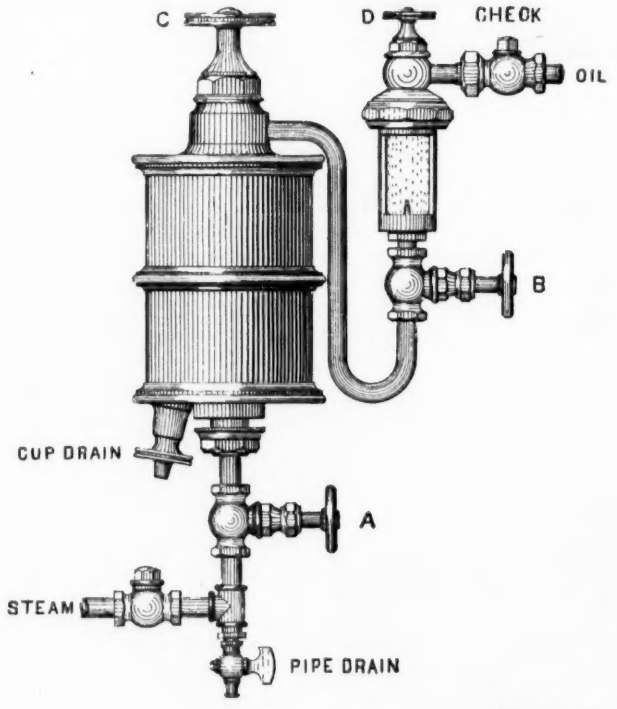
This is only one instance as an example of what is being done in the principal cities of the country.

The inventor, Charles F. Brush, who is a quiet, unassuming man, has been zealously at work in perfecting his inventions. While some have been engaged in heated newspaper arguments and in assertions of what might be done with the electric light, the Brush Electric Light Co. has been putting down its plants and has successfully introduced electric lighting.

There is an active demand for competent mechanical draughtsmen at good wages.

The Barclay Lubricator.

The steam engine lubricator represented herewith is intended for stationary engines, locomotives and steamships. The invention consists in a cup having a perforated diaphragm (with solid center) near the bottom, by which a general pressure on the oil may be obtained without any condensing tube in the cup, which can be worked either inside the cup or outside. The cup has given excellent results where used. The lubricator is placed on a small bracket, or on the wall of the engine room or bulkhead of a steamship close to steam pipe. A small quarter pipe passes from steam pipe near the engine up to the water glass, and a pipe of the same size leads from the top of the boiler into the bottom of the lubricator. For application to locomotives, it is necessary to first attach a small bracket to steam gauge in the cab and place the lubricator upon it with a lock nut on the bottom. Steam is taken from any convenient place on head of the boiler, or steam dome, sleeve of throttle stem, or injector pipe connecting with the bottom of the lubricator. The light feed can be placed on either side of the cup to make it right or left handed. A small pipe for conveying the oil to the steam pipe in the smoke arch to the check is attached to the water glass. The operation is as follows: When steam is up, open the pipe drain till steam comes, then close it, remove cap *C*, fill oil cup, remove cap *D*, fill water glass with water, then open steam valve *A*, *carefully*, to give the cup the pressure; then open regulating valve *B*, *very carefully*. The lubricator is then in operation. The inventor and manufacturer is Peter Barclay, Cunard Wharf, East Boston, Mass.



THE BARCLAY LUBRICATOR.

According to *Engineering*, a street railroad company in Leeds, after trial, have become convinced that steam as applied to their lines, is as economical, if not cheaper, than horse power in cases where two or more horses are required to draw a car.

Bits of Experience—No. VIII.

BY PROF. JOHN E. SWEET.

THE TROUBLE WITH "EASY WAY'S" STYLE OF COUPLINGS—THE MANUFACTURER'S END AND THE CUSTOMER'S END OF THE ROPE—HOW THE TAP MANUFACTURERS MIGHT FORWARD THE ADOPTION OF THE U. S. STANDARD THREAD.

There is hardly a subject in mechanics that comes up for discussion in the pages of the AMERICAN MACHINIST, or elsewhere, in which I do not have a desire to take part, and some in which the desire overweighs my good judgment, and I cannot resist the temptation to have my say. Your correspondent, "Easy Way," has hit one of my weak points, when he strikes the shaft-coupling question, and tells us just how to do it, which, it appears, he is the only man that has ever found out, whereas, the rest of us have been working for years to learn just how not to do it. Now, what I would like "Easy Way" to do, is to come and see a shaft that we have, that has been running about five years with his kind of couplings on it. The shaft is something over 100 feet long, and the shop 50 feet wide, and the most of the readers of the AMERICAN MACHINIST will understand when I say the shaft goes all over the shop. Nine-tenths of the trouble is due to the fact that the couplings were not worth the hole they have occupied in space for one week out of the 250 they have been in existence. The trouble is, that the ends of the two shafts not being of a size, the small one works loose, "chews" out the key-way and steel key, draws out, wobbles, and does everything a line shaft ought not to do. Some duffer has put a collar on the inside of the two end boxes to hold the shafts in, and occasionally music accompanies the gymnastics of the shaft.

An improvement on "Easy Way's" coupling was seen the other day, which consisted in cutting one-half of it in two pieces, crosswise, so that it would grip the two shafts independently. This, with "Easy Way's" key, for which he deserves the highest praise, and another improvement, that consists in cutting the key-ways in the shaft, the shallowest at the ends of the shaft, and the reverse in the couplings, so the shafts could never draw out, then the whole thing would be just about good enough to throw away.

What earthly use reamed holes and turned bolts—to bother in getting in and out and to cost lots of money—would be, is beyond my comprehension. The only place for collars on a line shaft is one at each side of the center box. Change in the length of the shaft, by a change of temperature, or throwing the hangers out by the shrinkage of the girders, will not cause friction on the collars or give more end play than desired.

Some years ago there was seen at Wood & Light's shop, in Worcester, what then seemed to me a good thing. The ends of the shaft were cut and hooked together as shown in Fig. 13. If there was any difficulty attending the use of this plan, I have not heard of it. Of all the couplings in use, Sellers' is the only one worth anything, and, as it is made, its worth is only in their own place, or shops like their own. Our neighbors have just been hammering away, getting one off that has been idle two years or more.

Ten or fifteen years' use in a grinding room or forge shop showed that getting off a Sellers coupling was not a noon-time job, and led to drilling and tapping an inch hole down through the middle of the shell. Screwing a pointed set screw into this hole forces out the cones, and the couplings can be taken off in five minutes at any time. The man who puts up a Sellers coupling without first drilling and tapping it, for the forcing apart set screw, misses it. Asking one of Sellers' men how they put up their couplings, and if they never had trouble in getting them off, he said they put them up perfectly dry. At another time one of the firm said they had no trouble; that they used the best of oil, and a few raps with a block of wood never failed to loosen them. No doubt both told it as it was, but the probability is neither had seen the couplings put into such conditions as we were using them under.

This reminds me of a peculiarity others may have noticed. Business men take special pains to remind manufacturers that there is a business end to the rope that they are constantly forgetting, while they are equally unmindful that there is also a manufacturers' end to the same rope. And so, too, the manufacturer reminds the customer of the same fact, while he forgets there is a customer's end also.

Another subject I am weak upon is screw threads. Am part owner in what I never expected to be—some V thread screw taps. Started out with the Pratt & Whitney U. S. Standard. Some got broken and others were wanted. We ordered through the dealer certain taps to be of a certain size. They came, and with all the faith a devotee has for his patron saint, they were placed in the hands of the workmen without examination. Some weeks after, when the attempt was made to put the work together, it did not go. Any man could see the taps were V threads. The fault was ours. Had we wanted U. S. Standard, why did not we say so? Smarting under this humiliating state of affairs, I was led to remark with more feeling than politeness, and more personality than was politic, that it seemed to me more might be done towards the establishment of the U. S. Standard if such establishments as the Pratt & Whitney Co., and the Morse Twist Drill Co., would print upon their circulars the notice that unless otherwise ordered the U. S. Standard would be furnished.

Fig. 13.

Eighty per cent., Mr. Stetson says, of the taps and dies ordered of or made by them (the latter company) are the V thread. Now it seems to me that the very practice they are following will tend to increase this 80 per cent. to 85 or 90 per cent., whereas a different course would tend to reduce it. My opinion is—and I believe an investigation would justify that opinion—that a large number using taps and dies would not know the difference, or care if they did know, whether they have the V thread or U. S. Standard. If all this class who have been supplied with taps and dies since the Franklin Institute recommended their Standard had been supplied with this class of goods, would not the 80 per cent. of Mr. Stetson have been greatly reduced? Also all who have ordered and forgotten to say they wanted the U. S. Standard, and thereby received the V threads, as I did, need to be deducted from the 80 per cent. There is no use in sending missionaries to a man who has just bought a full set of V taps and dies to set forth the advantages of adopting the U. S. Standard, for they have then cost him too much money. Better send him the right sort first and do the missionary work afterwards. When the ministers who have the heathen in their grip will do none of this missionary work, what can we poor colporteurs do, who are wandering in the desert with the culprits out of our reach and nothing to lasso them with?

Barnes' New Velocipede Lathe.

The lathe shown in the engraving on page 5, besides possessing all the advantages of a first-class lathe, has the following improvements: The leading screw is placed well under the edge of the bed, which is hollowed out for that purpose; it also brings the screw almost directly under the tool post, so that there is little of that peculiar twisting motion given to the carriage which is experienced upon some other lathes. The rack is also well protected from injury. An independent feed motion is used, which relieves the screw from unnecessary wear, when it is used both for feeding and screw cutting. The peculiar motion for transmitting the power, is of a design well calculated to produce a steady motion and overcome the violent jerking motion, which is almost unavoidable with a single crank. The seat is attached to the bed of the lathe by means of a strong hinge, and supported by a rod extending to the floor. The operator, in running this lathe, invariably sits, and can produce a steady, fast, or slow motion. The gearing is proportioned so as to give the best results for the power applied. These lathes are made with or without back gear, and the other motion is simplified, when necessary, for light work. The work is done in an excellent manner, and the machines are well adapted to the use of the amateur or practical mechanic. The Barnes lathe is made by W. F. & John Barnes, Rockford, Ill.

Compound Engine Discussion.

In the last three issues of the AMERICAN MACHINIST, we have published Mr. J. C. Hoadley's paper on the Compound Engine, which he presented before the American Society of Mechanical Engineers at their first regular meeting. The discussion which followed is given herewith:

Mr. Leavitt gave an interesting account of some experiments which he had made. In the course of his remarks, he said he had no doubt that a compound engine to do the same work would be the cheapest engine, but there was a great difference between mill engineering and pumping water. In pumping water, as Mr. Worthington had conclusively shown, it was necessary to move slowly. When it came to mill engineering, they had in their teeth the high speed engine. He had no doubt at all that the mill engine of the future would be a high-speed engine. From the very best construction of single cylinder engine, the best result obtained, of which he had any knowledge, was not less than 21 pounds of feed water per horse-power per hour, and he knew from the practice at the Calumet and Hecla, where accurate records were kept,

that they had run with 16 pounds. Speaking of the Corliss engine, he said that he was very much surprised to find, when Mr. Corliss built his engine at Pawtucket, that he obtained within one per cent. as good an effect, theoretically, as could be obtained from the best type of Woolf engine. In the cards from the marine type of receiver engine, he (Mr. Leavitt) had not found anything like the same degree of economy indicated. Finally, a set of cards (from the Pawtucket engine) were found which showed considerably more steam in the low pressure cylinder than came out of the high. At the time, he supposed that Mr. Corliss must have taken a pipe from the boiler direct and led high pressure steam into the receiver. It came out at last, however, that Mr. Corliss had taken the condensation from his jackets and receiver, passed it through a coil in the chimney, and returned it to the receiver in the form of superheated steam, with the result that, not only the card from the high pressure cylinder showed five expansions and followed the curve of Mariotte's law, but the card from the low pressure cylinder with four expansions followed a similar curve (making the ratio of expansion in both cylinders twenty), and he had produced an engine that probably, theoretically, was the most perfect steam engine ever made. This engine, having cylinders 15 and 30 inches diameter and only 30 inches stroke, produced a horse power with about 1.65 pounds of coal per hour, and the secret of its great economy was undoubtedly in the fact, that, by this ingenious method of returning super-heated steam to his receiver, Mr. Corliss had reduced the internal radiation from the low pressure cylinder to a minimum.

Prof. Robinson thought there was no doubt that in a compound engine having a receiver, if the steam was passed through a superheating apparatus it was very much improved in its condition for action. Some years ago he had read a notice of the performance of the Worthington duplex engine, which was so constructed that the steam was exhausted from one cylinder into a receiver. The low-pressure cylinder being larger than the high pressure cylinder, there was necessarily expansion somewhere between the steam in the first cylinder and that in the second. He had attempted to analyze that engine, and find the efficiency of it. On getting at the query as to the condition of the steam in the intermediate receiver, he could only conclude that it was wiredrawn by the exhaustion from the high-pressure cylinder into it, that is expanded without doing work, in which case it retains all its intrinsic energy, so that it would do nearly the same work in a low pressure cylinder exhausting into a vacuum, as though not thus expanded. But in exhausting into the atmosphere it would do less work, as is evident from the fact that, in this case it would do no work if wiredrawn to atmospheric pressue. But as compound engines are usually condensing he had come to the conclusion that the receiver was no serious drawback. There would be a slight loss, due to the expansion into the receiver, which would depend largely upon the pressure of the steam in the condenser. In regard to the steam jacket, he thought that, speaking from theory, without reference to experiment, there was a chance to doubt the efficiency of the steam jacket. At least one German writer had raised a caution in regard to it, on the ground that the problem in the solution of the steam engine should be to reduce the steam to the lowest temperature possible. If the temperature could be reduced to the absolute zero, of course all the work put into the steam, and some more, perhaps, could be recovered. The statements of Rankine went to show that there was economy in the steam jacket, and it might, perhaps, be accepted on that authority; although he did not give any examples to show in particular cases an increase of the efficiency of the engine. The supposition must be, if there were an economy in the steam jacket, the heat communicated from the steam jacket to the steam was more efficient in performing work than the heat which was in the steam itself.

Prof. Sweet said that he supposed that Mr. Hoadley's diagram represented pretty accurately what the best engine builders had been endeavoring to produce with their engines, that is cards with sharp corners, with the exception of the compression corner. He had been firmly of the opinion that that diagram did not represent the best results obtainable from the engine. The diagram should come forward a distance equal to the co-efficient of friction, and then go up to the boiler pressure, come forward level with boiler pressure, and then expand down—not to the end of the stroke but to some point short of that, and then run to the bottom line. There was a certain point where excessive pressure did more harm than good, by producing friction on the journals.

Mr. Porter said that at the commencement and termination of the stroke, the friction on the crank pin was undoubtedly excessive, relatively to the rotative effect produced, as the crank pin is then moving at right angles with the direction of the pressure. The friction of the journal in its bearings at that point was also extreme, but, at the same time, it appeared to him that there was not much in the point. Mr. Porter then explained his meaning more fully with the aid of the diagram, showing that the admission of the steam on the very center enabled it to do work, additional to that done by the same quantity admitted gradually as the piston advanced, that is much in excess of the amount required to overcome the additional friction that its early admission produced. He thought the long communications of the Woolf engine a serious objection to it. In a great many diagrams from compound engines, the low-pressure cylinder would not account for more than half the steam the high-pressure cylinder accounted for. It had probably been condensed between the two cylinders.

Mr. Leavitt said that the marine engineers at first made very large receivers, but in all the later engines the size was steadily being reduced.

Answering a question of Mr. Church's, Mr. Leavitt said that, according to his experience, the compound engine was a better regulator than the single-cylinder engine under a variable load. It was found, for instance, that with an engine where nine-tenths of the load was thrown on at once, the regulation was very uniform. He thought Mr. Worthington's engine the most remarkable example of the efficiency of the compound engine. He had seen at Toronto an engine in which the ratio of the cylinders was 4 to 1, and that engine was making its full stroke under a very heavy pressure.

Mr. Worthington said that the engine worked as Mr. Leavitt had testified, and that the reason why, he supposed, was to be found in the fact that, by some little intermediate contrivances, the propulsive energy of the steam was taken from the commencement of the stroke and held until the last part of it. There was quite an expanding chamber in the steam chest and in the large pipes thereto connected, so that the steam pressure was rapidly reduced when it left the first chamber. The propulsion was practically very nearly uniform. He never could see that anything could be claimed for the compound engine which could not be claimed for the single engine theoretically. The world believed for a long time that the compound engine was only an inferior form of the single-cyinder engine. He had said that he never expected to see any single-cylinder crank engine beat his engine in duty. He had written that and still believed it. But when the compound engine came into the arena, especially under the handling of Mr. Leavitt, he knew that his prestige, as to duty, was handsomely eclipsed.

Mr. Holloway had always looked upon the receiver of the compound engine, particularly when applied to marine work, as a necessary nuisance. He thought that the great efficiency of Mr. Leavitt's engine was due to the fact that he had been able to do without a receiver.

Mr. Worthington said that he used the intermediate receiver for the purpose of distributing the pressure uniformly throughout the stroke. But he should hesitate long before he would conclude that it was a necessity on a crank engine.

Mr. Leavitt said that the Inman Line, in their earlier ships, used the ordinary two-cylinder receiver type of engine. They then, for some reason he had not heard explained, went over to what was called the tandem engine, and in their new steamship the City of Rome they were using six cylinders of the tandem type.

Mr. C. E. Emery did not agree with Mr. Hoadley as to the very great value of the friction, in explaining the difference between the compound and the non-compound engine. Describing an experiment he had made some fifteen years ago, he said that he took a piece of gas pipe 18 inches long and 1½ inches inside diameter, and fitted it at the bottom with a shoulder to screw down through a valve. The valve was arranged to admit steam from the boiler, and exhaust it to a little coil in a vessel of water. This valve was operated regularly by the engine, and filled the little cylinder, and so by putting on a counter, he found how much steam it took to fill and exhaust that cylinder. In addition to the iron cylinder, a glass one was made of the same inside diameter and length. It had rubber on the end to make a non-conductor, and yet the glass cylinder only measured off half the quantity of steam the other did. That showed that condensation took place, due to those differences of temperature. Here was a reason why the compound engine was more economical in steam and heat than the single engine. He agreed with Mr. Hoadley's explanation to a certain extent. At the time the piston was passing the center, the pressure upon the piston was received by the cross head upon and behind the crank pin. But the losses were not those due to pressure; they were those due to the work; to the pressure moving through distance. So that, although there was enormous pressure at the beginning of the stroke, there was no loss whatever except what was due to the revolving of the crank pin through its brasses. There would be a slight loss due to the motion of the connecting rod at the crossing. There was none due to the motion of the cross head itself. As the circumference of the crank pin might be two-thirds to a half of the length of the stroke of the piston, there would be a loss, due to this pressure on the crank pin itself, of one-half to two-thirds of the friction due to the pressure on the piston at that point, for the coefficient of friction in that case is something like 2½ per cent. An engine would work easier if it had the lowest pressure at the beginning of the stroke, and it was very common for engineers to set their valves back. It was a point to set the cut-off on the first cylinder at about $\frac{4}{10}$, so that it could not be carried any further, and then that was full stroke for the engineer. In order to get his speed at that point he would have to carry over fifty pounds of steam, and as he would have to cut down a little he would naturally carry sixty pounds; and by that maneuvering, the marine engineers were forced to carry that high pressure of steam.

Mr. Webber said that the "Gallia," of the Cunard line, had a compound engine with one high pressure cylinder and two low pressure cylinders, and that on the round trip the consumption of coal was at the rate of 1.81 lbs. per horse-power per hour, while the "Hudson," of the Cromwell line, with a single engine, made the round trip from New York to New Orleans on 1.31 lbs. of coal.

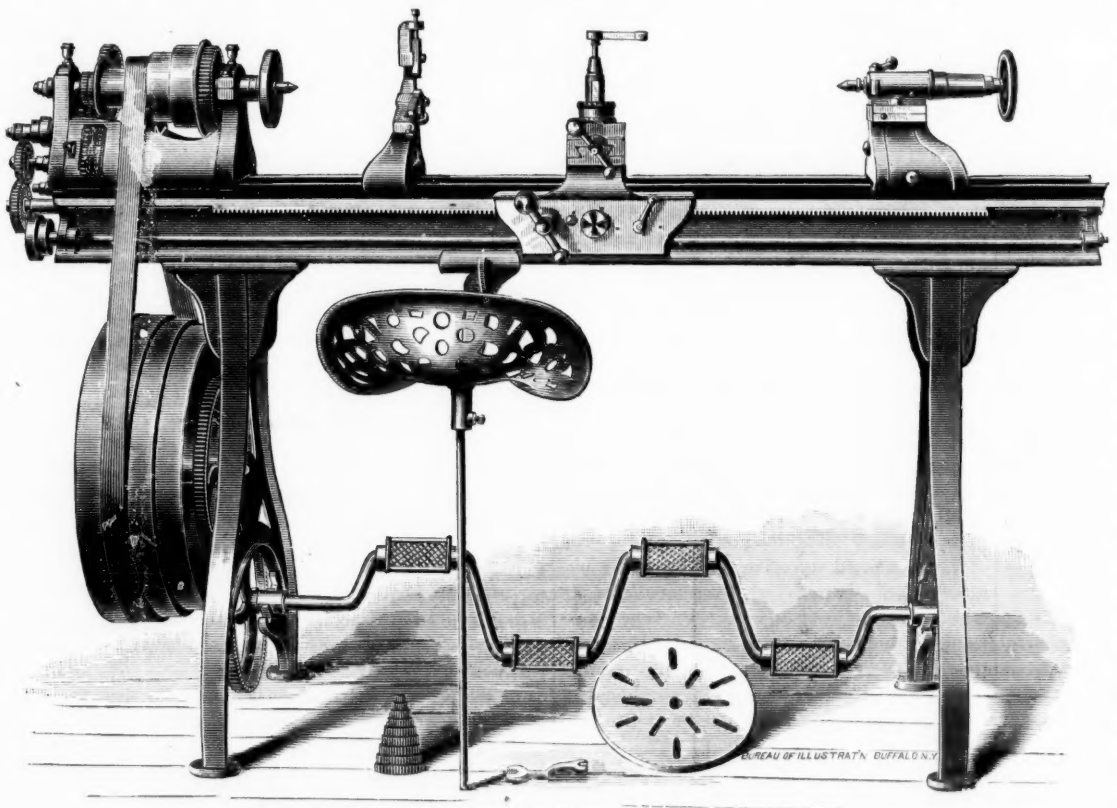
Mr. Sterling said that the owners of the line to which the "Hudson" belonged had recently built a steamer for their line, but they did not put in a single cylinder engine.

Mr. Worthington supposed that the figures given by Mr. Webber were obtained from indicators. He knew of nothing more deceptive than indicators, especially in unpracticed hands.

Mr. Porter had occasionally loaned an indicator, and he had never had it come back again in a condition fit to be used. It had to be thoroughly repaired before it was fit to take a diagram with. Still, diagrams had been taken by it in that condition, and used as a basis for calculation.

A discussion of some length followed, in which a distrust of indicators, as ordinarily used, was strongly expressed.

Mr. Leavitt, speaking of steam jackets, said that he used to shut them off sometimes:



BARNES' VELOCIPEDE LATHE.—SEE PAGE 4.

and the fireman would come up and want to know what was the matter, he could not keep up steam. In his opinion, while steam was expanding from 12 to 14 times the efficiency of the steam jacket was from 15 to 20 per cent.

Mr. Worthington thought that that might be true, but it had not been realized in his experience. He would use the jacket as a matter of advantage to the engine.

Mr. Faber du Faur said that Mr. Althaus, who was on the jury in the exhibition of 1876, designed a 3-cylinder engine, the cylinders standing side by side. The line of the diagram would be almost a horizontal line. He thought such an engine would be well adapted for pumping purposes.

LETTERS FROM PRACTICAL MEN.

Lubrication of Machinery.

Editor American Machinist:

Many very respectable people who have to do with machinery think of a lubricant as no essential part of a machine, and not included in its design—that it is merely an afterthought brought in to make the thing go, but used only under compulsion and with more or less of mental protest. It seems to be thought that while oil is good to stop squeaking and generally makes things run easier, its use still argues the imperfection of human methods. And so the proprietor who pays his dollar for coal cheerfully enough, grumbles over the cent which goes for oil, and sighs for the day when machinery will be perfect, and consequently will run smoothly without greasing.

Now, I know that many of man's devices have no counterpart in nature for the simple reason that they are too costly. Nature can't afford to use cog wheels, for instance. Where we employ a wheel we generally use but a single point of its circumference at a time and the remainder is, until its turn comes, useless. Nature does her work by more economical means. Man's chief progress consists in the replacing of his earlier devices by more natural ones. With regard to the lubrication of machinery no such retrogression is demanded. The joints of animals are oiled, and even the paths of the fishes in the sea are lubricated with a nicety that the art of man has not approached.

A lubricant seems to have two distinct functions, neither of which should be lost sight of by the mechanic. It not only provides rollers, as it were, by which the movement of one surface upon another is facilitated, but it fills the interstices and brings a much greater portion of the two surfaces into connection with each other, and thus distributes the pressure to which they are subject as widely and evenly as possible. This latter office the lubricant is especially called upon to exercise upon cylindrical surfaces which run together. The diameter of a journal is of necessity somewhat smaller than that of the box it runs in. Any machinist who, with the most rigid of calipers, makes a fit, "iron to iron," knows that he has a snug driving fit, and if the shaft is to run easily it must be considerably smaller. The shaft being smaller than the box it can, theoretically, touch but at a single point, and this is not far from the practical truth. Let the fit be as accurate as can be made and the box heavy enough to absolutely retain its cylindrical shape. Let the box and its shaft be kept most rigidly in line, or better yet, let the one be free to accommodate itself to the other and the lubricant is still essential, not merely as a lubricator, but also as the filler of the respective surfaces and the distributor of pressure over them. Oil should be considered as much and as constant a part of a journal box as the connecting rod is a part of the steam engine.

The scientific man and the practical man are prone to speak slightingly of each other. I depart from the usual custom sufficiently to say that in the matter of heat I incline to think that science has developed a square thing. The interconvertability of heat and other forms of force, every practical man is bound to respect. In the light of it the wastefulness of our practice is brought to view.

When we learn how great a force a little heat represents, we find that heat an expensive tell-tale. It is time to oil a box a long time before it gets hot. It costs too much to heat it. There is no right way to oil anything but to oil it constantly and steadily.

There is a method of lubrication becoming widely diffused which is strikingly ingenious. Suspend a pot of grease over a journal and have a loose copper wire running down through it and touching the journal aforesaid; then when the journal gets hot the wire gets hot, and when the wire gets hot the grease gets hot, and when the grease gets hot it runs down the wire that is hot upon the journal aforesaid, which is hot, and the journal which is hot, but which, as I maintain, should not have been hot, is triumphantly cooled. Now, this may be a very nice safety arrangement to prevent things taking fire, but as a sole means of lubrication it is barbarous.

I have often laid my hands upon a piece of wrought iron turning in the lathe and noticed that there was quite a difference in the feeling of the surface whether the hand passed over it in the direction (circumferentially, I mean) in which the tool passed or the reverse. It will be found to feel roughest (contrary to the natural expectation, probably) to the touch when the hand passes in the same direction as the tool.

Well, if it feels differently it is different. Now I wonder if any one has thought of noting what difference it makes as to the direction in which a turned piece should revolve in a bearing to wear the best, and whether it would not be proper for the makers of turned shafting to indicate, by an arrow or otherwise, the direction in which a shaft should run.

FRANK H. RICHARDS.

Troy, N. Y.

Maintaining Standard Cylindrical Sizes.

Editor American Machinist:

I will explain in this letter how to maintain standard sizes in the production of small cylindrical articles, and how to test their accuracy when made.

Never depend upon, or use to work by, unadjustable gauges with either holes or niches as standards of size. For each size to be produced or tested, have a sample of the exact size required. To the sample "set" an adjustable gauge, not making a tight fit, but so close that an educated, sensitive touch can feel that "it fits" and still requires no pushing to "make it go."

Perhaps some reader, believing firmly in the use of fixed gauges, will ask just here, "Why this roundabout way to reach the desired end?" If such a one would try, the reasons would be obvious. Some of the reasons the writer will endeavor to make plain.

The main objections to fixed gauges are that they only gauge that which they perfectly fit. In case a piece too large or too small is tested, the gauge does not indicate how much it varies from the size required, but leaves it entirely to guess-work as to how much the piece "too large" shall be reduced, or how much larger than the piece "too small" is required to fill the gauge. Add to this the fact that, from the first time the gauge is used it is subjected to an amount of wear which will soon carry it above standard size, even if properly treated, while it is almost certain to be abused by having pieces a "little too large" pushed in and driven or wrung out, and we have sufficient cause for adopting some other plan.

Hoping that the attention of a certain class of mechanics has now been insured by an attack upon their pet gauges, the consideration of the advantages of working by sample is in order. With the adjustable gauge, preferably the micrometer caliper "set" to the standard sample, the effect is to produce or select pieces which fit the gauge precisely as the sample does.

If a piece is too large, open the gauge and learn how much; if too small, close the gauge upon it. If a limit of variation is allowed above or below, or both, and the micrometer is used, the holes, so often seen marked "go in," "not go in," may be dispensed with, as they should be, because in practical use they only tend to deceive. Of course, if no pieces are made which go in the "not go in" hole there will be no wear upon it. But how about the other hole into which every piece must go or be condemned as too large? Think of the pushing and wringing to get pieces in which are a "little too large," and consider that while the limit of difference may be originally one-thousandth of an inch, or possibly not more than one quarter of that, the continued wear resulting from use may increase this difference to even one-hundredth of an inch, and still the arbitrary command stamped in steel, "go in," be complied with.

From an experience of many years the writer has no hesitation in stating as his opinion that a round sample of size, of from one to two inches in length, depending upon size used in connection with the micrometer caliper, will remain "standard" size a greater number of years than the so-called "standard" gauges will days. The reason for this is that in adjusting the gauge to a "standard" sample it only comes in contact with two points in the circumference, and but a short portion of the length and is not violently pushed on.

By adopting this plan, *the wear is transferred from the standard to an adjustable gauge.*

To the man who thinks I have not made a case, I say, "try it," and you will soon admit the force of my reasoning, besides entering upon a course of training which will educate your sense of touch, until in the measurement of small articles from one inch down, a variation of the ten-thousandth part of an inch will seem larger than a thirty-second did in the days of boxwood rules and caliper standards. You will soon find yourself measuring quarter and half inches, with all other divisions, by thousandths, and will learn that any division on the scale may be measured in that way. 0.250=quarter-inch may be measured by a thousand operators, scattered all the way from Maine to Texas, and bringing together the results, the aggregate difference will not be so great as between two skilled mechanics who measure by the scale and calipers.

With all the justifiable growling about lack of uniformity in drills, reamers, taps, screws, bolts, nuts, etc., made, not only by different manufacturers, but by different men in the same shop—is not this "the way out of the woods?" I have been pursuing this plan for years, and am growing to like it better daily. Respectfully yours,

S. W. GOODYEAR.

Pittsburgh, Pa.

Qualities of Plumbago for Lubrication.

Editor American Machinist:

I have just read the article "Plumbago as a Lubricator," by Wm. J. Williams, in the AMERICAN MACHINIST of October 16th last. I do not know Mr. Williams, but he announces himself to be "an engineer of some years' standing," and by the dates of his two articles, it would appear that he has handled plumbago as a lubricator during the past two years—in 1878 with a favorable result, and in 1880 with the reverse result; but it does not seem to have occurred to him that plumbago varies in quality and character as widely as any known substance. His only remark about the quality of the article he used is contained in these words: "As to the quality of the plumbago both Ceylon and American were experimented upon, and *so far as the eye could detect, there was no foreign matter contained in either.*" This remark shows how absolutely worse than useless were Mr. Williams' experiments, and how little he knows about plumbago.

I am somewhat familiar with the grades of plumbago produced at every mine in the world, and I do not know of a single instance in which it was ever mined in a condition of purity that made it useful for lubricating. Lubricating plumbago, or graphite, is therefore a product of manipulation, or some process of purifying, and these products will vary as widely, and some of them will prove to be as suitable, while others will be found to be as unsuitable, for certain uses as the widely differing products of iron ore. In the first place, none but the foliated graphite is suitable for lubricating, and yet when taken from the mine there will frequently be found between the laminae a fine grit that is almost as destructive in lubricating as fine emery, but no human "eye" can "detect" it. It is there, however, and is easily detected. Suitable treatment will remove the grit and leave this formation of graphite a "perfect lubricator," as soft and smooth and unctuous as the oil from an Alaska seal.

Such a graphite is a lubricating material not equaled by any other known substance. I will gladly furnish Mr. Williams with a graphite prepared for lubricating, that he will himself acknowledge cannot under any "conditions" whatever be made to wear away a metallic surface, but that will, on the contrary, save all metallic surfaces from wear, and consequently from heat, so long as a particle of the graphite remains between them, no matter how rapid the motion nor under what pressure.

Very respectfully,

ORESTES CLEVELAND,
President of the Dixon Crucible Co.,
Jersey City, N. J.

Fitting up Journals.

Editor American Machinist:

One of your correspondents uses lead laps and emery for polishing journals. Is it not recognized good practice to finish all wearing surfaces without the use of emery? We all know that filing a journal makes it more untrue. Emery will do the same. It cuts away the soft places faster than the hard ones. If the work is not round and true emery will not make it so. On steel, emery is only less objectionable than on wrought and cast iron. Perhaps the best way to finish journals is to scrape them in the lathe with a keen edge tool. This will require some patience and practice, but the surface will be truer if not so smooth. It will take longer to finish a journal in this way. But the truer a journal is the longer and more satisfactorily it will wear. And so the better such work is, the cheaper it is—especially to the user.

Another of your correspondents says, in effect, that one cause of heating journals is that they are out of round. This is no doubt true to a greater extent than many of us have hitherto supposed. I would scrape journals; using oil, but no emery, and file as little as possible; using a fine file, if any at all.

By the way, let no one ever expect to make a good journal bearing on a common wrought iron shaft. That is one of the impossibilities. It will be a good thing for the machine business when wrought iron for bearings is wholly superseded by a proper grade of steel.

H. NORTON.

Bernardstown, Mass.

Case-Hardening Small Iron Articles.

Editor American Machinist:

I saw in your paper last week a request for some information about case-hardening iron set-screws, etc., from W. M., of Niles, Michigan. I do not know that you would wish to publish anything more about case-hardening, but I feel it my duty to speak at the present, if I must ever after hold my peace.

I have had a considerable amount of that class of work to do and have tried a great many ways, and as many different things, and, after giving all a fair trial, I have found the following to be at least one hundred per cent. better than anything else I have ever used, or heard of, for small work, such as binding screws, set screws, gun lock work, or anything of that class: Take an ordinary sand or plumbago crucible, large enough to hold about two or three times

the quantity of work you intend to harden; fill the crucible half way up with equal parts of fine salt and cyanide of potash; set it in the fire and heat up slowly, until the contents are fused (which will be as thin as water). Now, having the work ready, plunge them all in together, and, for a thin skin of hardening, five minutes will be enough, but if you wish a hard and thick film, it will be necessary to keep them in for a longer time. Afterwards the whole contents of the crucible must be poured quickly into cold water, not less than twelve inches deep, as the articles should become nearly cool before reaching the bottom. If the work be finished to a smooth surface, before hardening, they will come out a beautiful grayish white and as hard as glass.

W. S. HARRIS.

Croton Falls, N.Y.

Machine Shop Floors.

Editor American Machinist:

This subject having been discussed recently in your paper, and perhaps not exhausted, I would submit a word or two thereon. Ground floors for heavy work, made in the ordinary way, besides being objectionable for sanitary reasons, by permitting emanations from the ground, are expensive to maintain, as they are constantly deteriorating by rotting and by being broken. The principle cause of breaking up is from driving. This process must be constantly going on here or there all over the shop, and a plank floor is a very poor thing to drive on, apart from the injury it suffers. Let provision be made for driving at intervals of from, say, ten to twenty feet along all the passage ways. Among the lathes, put down driving blocks in nooks where a hollow post for driving mandrels may stand. Then make the rest of the floor of broken stone, covered with asphalt concrete. Keep some of the material on hand, and when a spot breaks up (which, I think, would be seldom), heat up some of it and patch the hole. To put down a driving block, let a hole be dug about three feet in diameter and five feet deep. Put down a stone foundation, or a single stone, if convenient; bringing it up to within two feet of the surface. Then a section of a log, two feet in diameter and well tarred on sides and bottom, stands with its top flush with the floor. Live oak would be suitable for the blocks, and would never need renewing. Of course, these blocks would be all put in position before the stone floor is laid. All driving would be naturally done on the blocks, as affording the best place, and I cannot see how such a floor would ever need much repair.

Respectfully,
H. W. P.

Philadelphia, Dec. 6, 1880.

Heavy Power Press.

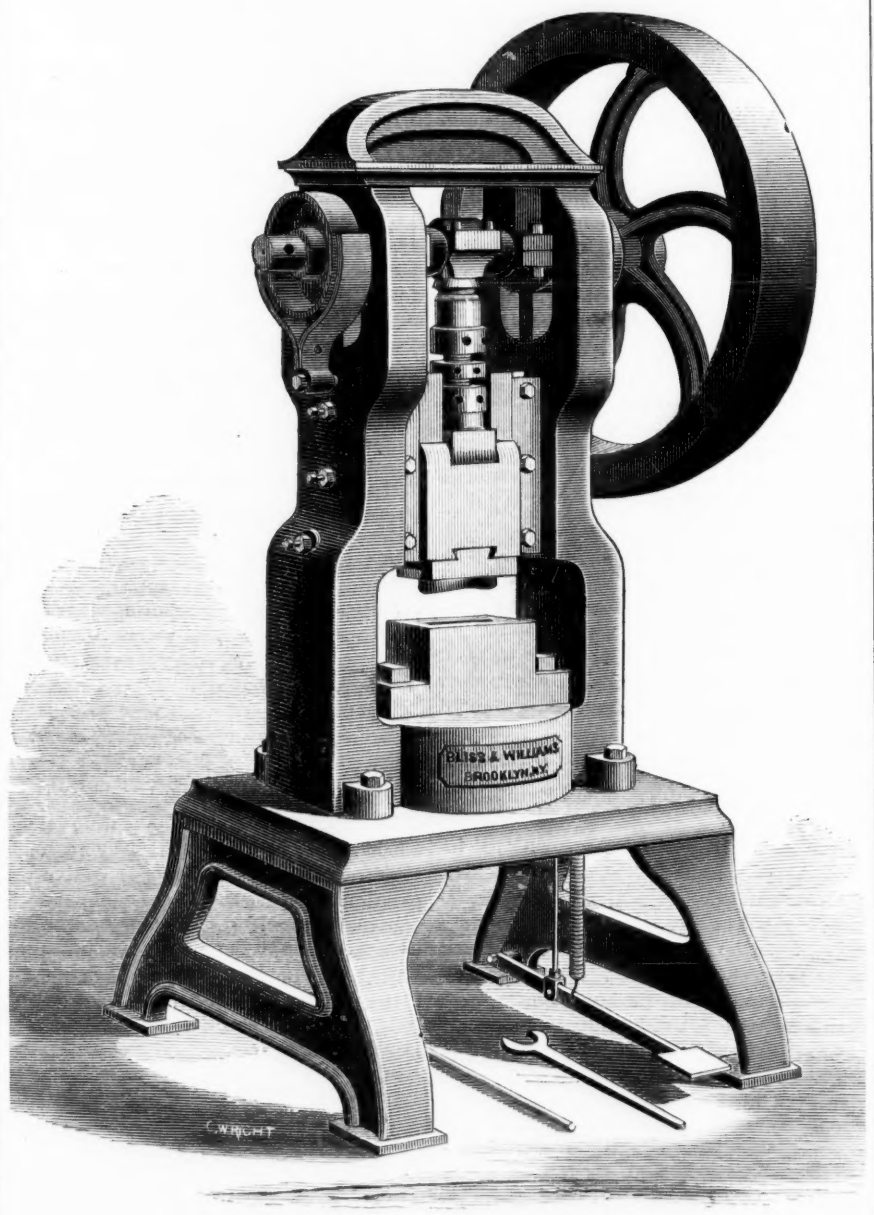
The power press shown in the engraving is designed for cutting or blanking heavy work, such as spoons, forks, ladles, sewing-machine bases, etc., having a solid frame cast in one piece. This secures great strength, with an increased space between the mandrel and bed to give ample space for handling and working dies. The driving shaft is of steel, while the pitman has right and left threads to adjust length of stroke to work so as to secure proper depth. The wheel runs free, enabling a touch of the treadle to engage the clutch. The shaft makes a complete revolution, or, if desired, may stop with the crank at the highest point. The mandrel or slide runs in solid guides, with adjusting gibs to compensate for wear. The brake at end of shaft is intended to supplement the clutch, insuring prompt stoppage of crank at the highest point when desired. The general arrangement of the machine unites great strength and firmness with economy of space, while keeping the strain in line with the metal. The press weighs complete about 4,400 lbs. The size of opening in the bed is 12 inches round, or as desired, while the distance between the uprights is 24 inches, and distance from bed to bottom of slide, when slide is up, is 13 inches. This press is made by Bliss & Williams, Plymouth, Pearl and John streets, Brooklyn, N.Y.

Newly-Incorporated New York Companies.

Jones Car Manufacturing Company, Rotterdam, Schenectady County. Jno. H. Jones, Walter A. Jones, and James B. McLeese, incorporators. Capital, $50,000, in shares of $100 each. For the manufacture and sale of street tram cars, railway cars and coaches, and all kinds of vehicles to be used on highways. Dec. 2.

The Brooklyn Railway Supply Company, Brooklyn. James Bain, Charles B. Allyn and others, incorporators. Capital, $10,000, in shares of $100 each. For the manufacture of railway sweepers, apparatus, furniture, and such other manufactured articles as are required and used by railway companies. Dec. 2.

The Gas Carburetter and Economizing Company, New York. Henry Hermann, Fred'k Young and others, incorporators.



HEAVY POWER PRESS FOR CUTTING OR BLANKING.

Capital, $1,000,000, in shares of $100 each. For the manufacture and sale of gas carburetters and economizers, under patents of Peter Keller. Dec. 3.

The Standard Collar Company, New York. Jas. H. Hoffman, Julius Levine and others, incorporators. Capital, $6,000, in shares of $50 each. For the manufacture and sale of collars and cuffs and like articles. Dec. 4.

Union Electric Manufacturing Company, New York. Francis A. Hobert, Charles D. Haskins and others, incorporators. Capital, $100,000, in shares of $100 each. For the manufacture and sale of electrical and telegraphic instruments, and supp'ies. Dec. 4.

William Roworth's Sons' Manufacturing Company, New York. Jos. G. Roworth, Jno. W. Roworth and J. Fred. Roworth, incorporators. Capital, $75,000, in shares of $100 each. For the manufacture and sale of confectionery, pharmaceutical preparations, and articles for domestic and toilet use. Dec. 4.

The American Steam Appliance Company, New York. H. T. Horton, W. A. G. Horton, and J. A. Edwards, incorporators. Capital, $200,000, in shares of $25 each. For the manufacture and sale of steam appliances. Dec. 4.

Star Chemical Company, New York. David Fulton, James Goldey, and J. D. Sproull, incorporators. Capital, $30,000, in shares of $100 each. For the manufacture and sale of starch gloss, ducoctorine, and other similar compounds for laundry and toilet use. Dec. 6.

The Juvenile Clothing Company of the City of New York. George Doyle, Charles E. Randell and others, incorporators. Capital, $100,000, in shares of $50 each. For the manufacture and sale of clothing for children and other persons. Dec. 7.

Duplex Manufacturing Company, Limited, New York. Thomas H. King, Frederick A. Jones and others, incorporators. Capital, $30,000, in shares of $30 each. For the manufacture and sale of duplex and friction bearings, and their attachments, under patents granted to Thomas H. King. Preliminary certificate filed Nov. 26.

The Central Fire Cartridge Company, New York. A. M. Helmen, A. H. Almy, and S. W. Wood, incorporators. Capital $1,000,000, in shares of $10 each. For the manufacture and sale of military and sporting cartridges. Dec. 8.

The United States Ozone Company, New York: Edward Connor, Allen N. Leet, and others, incorporaotrs. Capital, $100,000, in shares of $100 each. For the manufacture and sale of Ozone generators and Ozone machines—Dec. 10th.

The Salamanca, Bradford and Allegheny River Railroad Company, of New York: Geo. F. Tyler, Clarence H. Clark, and others, of Philadelphia, and Henry A. V. Post, and others, of New York, incorporators. Capital, $850,000, in shares of $100 each. To construct, maintain and operate a railroad company at a point on the line between the States of New York and Pennsylvania, where the Allegheny river crosses said line, and running thence northeasterly to a point in or near the town of Salamanca. Length of road, about twenty-four miles—Dec. 11th, 1880.

Concave Spring Company, New York: A. E. Scott, Jno. F. Scott, and others, incorporators. Capital, $100,000, in shares of $25 each. For the manufacture and sale of steel springs, under Edward Spaulding's patents—Dec. 11th, 1880.

The Wilson Chemical Fire Extinguisher Company, of Buffalo: James R. Wilson, N. Rochester, and others, incorporators. Capital, $40,000, in shares of $100 each. For the manufacture and sale of fire extinguishers, and apparatus and machinery for extinguishing fires—Dec. 13th.

Conklin Wood Works, of Conklin, Broome Co., N. Y.: George C. Edwards, Geo. W. Emmons and Harvey F. Doyle, incorporators. Capital, $6,000, in shares of $25 each. For the purpose of manufacturing, dressing and preparing lumber, and the sawing and working of all kinds of wood—Dec. 15th.

Newly Incorporated Massachusetts Companies.

Globe Rubber Company, of Hyde Park. Amos Webster, president; Arza B. Keith, treasurer. Capital, $12,000, in shares of $100 each. For the manufacture of fabrics in part made of rubber or similar gums, and the manufacture of articles made in whole or in part of said fabrics.

Sagamore Gas Light and Heating Company, Lynn. Edward Mahon, president; J. Francis Mahon, treasurer. Capital, $100,000, in shares of $100 each. For the making and selling of gas for lighting and heating purposes.

The Harvard Clock Company, Boston. Samuel S. Campbell, president; Charles M. Campbell, treasurer. Capital, $40,000, in shares of $100 each. For the manufacture and sale of clocks, watches, and time-keeping instruments.

Allston Car-Wheel Company, Boston. Charles Bullock, president; Frederick A. Hondlette, treasurer. Capital, $100,000, in shares of $100. For the manufacture and sale of car wheels and other castings, also of machinery, tools, and other metallic products.

Eastern Junction, Broad Scurd Pier and Point Shirley Railroad Company. G. C. Brown, Horace Farrington, Fred H. Henshaw, Lyman S. Hapgood, William C. Craig, A. D. McClellan, Joseph E. Merrill, Alpheus P. Blake, David Loring, Charles C. Barton and Thomas A. Henshaw, directors. Capital, $100,000, in shares of $100 each. To commence at a point on the Eastern Railroad in Revere to extend through a portion of Revere to Broad Sound Point, from thence along the line of the ocean through Winthrop to Point Shirley, its terminus. Length, about 4 miles; gauge, 4 feet 8½ inches.

The Boston Chair Manufacturing Company, Boston. Cyrus Wakefield, president; W. G. Wheildon, treasurer. Capital, $100,000, in shares of $100 each. For the manufacture of chairs and other articles of wood, and other materials.

The Boston Terra Cotta Company, Boston. Geo. M. Fiske, president; James Edmond, treasurer. Capital, $10,000, in shares of $100 each. For the manufacture and sale of terra cotta.

Holyoke Envelope Company, Holyoke: James T. Abbe, president; Geo. N. Tyner, treasurer. Capital, $30,000, in shares of $100 each. For the manufacture and sale of envelopes—Dec. 10th.

Lee Gas Light Company, Lee: Nicholas C. Miller, president; Wm. E. Hoxie, treasurer. Capital, $25,000, in shares of $100 each. For the making and selling of gas for light and other purposes—Dec. 13th.

Edward Atkinson, President of the Boston Manufacturers Mutual Fire Insurance Co., says in a recent report: A mineral oil that flashes at less than 300° F. does not possess the best qualities for lubrication, and is unsafe in proportion to the lesser degree at which it flashes. The quantity of oil used is a matter of much less importance than the quality. The mill that saves gallons of oil at the cost of tons of coal, or dollars of repairs, plays a losing game. No vegetable oils are fit to use as a lubricant—if used, will surely set the mill on fire. The rule of best lubrication is to use an oil that has the greatest adhesiveness to metal surfaces, and the least adhesiveness as to its particles. Fine mineral oils stand first in this respect; sperm, second; neatsfoot, third; and lard, fourth. Light-gravity mineral oils, as a lubricant, showed the least friction under low temperature.

An average of about sixty patents a year is taken out by women in the United States. Among the novelties patented during the year ending July, 1880, was a dress protector, a washing machine, a sewing machine treadle, a wash basin, a window cleaner, a milk cooler, and a sofa bed.

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☞ *We invite correspondence from practical machinists, engineers, inventors, draughtsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

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NEW YORK, JANUARY 1, 1881.

CONTENTS.

PAGE.

Improved Compound Pumping Engine..... 1
Extracts from Chordal's Letters..... 1
New Shaping Machine and Gear Cutting Machine. 2
Lighting Broadway with the Brush Electric System 3
The Barclay Lubricator..... 4
Bits of Experience. No. VIII. Prof. Sweet..... 4
Barnes' New Velocipede Lathe..... 4
Compound Engine Discussion..... 4
Letters from Practical Men—Lubrication of Machinery—Maintaining Standard Cylindrical Sizes—Qualities of Plumbago for Lubrication—Fitting up Journals—Case-Hardening Small Iron Articles 6
Newly Incorporated New York Companies..... 7
Newly Incorporated Mass. Companies..... 7
A Plan to Assist Apprentices..... 8
Another Special International Exhibition..... 8
Our Letters from Practical Men..... 8
Progress of the World's Fair Enterprise..... 8
An Important Legal Decision..... 8
Government Record of Marine Accidents..... 8
Systems of Life Insurance..... 9
Literary Notes..... 9
Questions and Answers..... 9
Manufactures..... 9
Machinists' and Engineers' Supplies..... 10
Iron and Metal Review..... 10

A Plan to Assist Apprentices.

As we begin a new volume, no more important subject can first engage our attention than the consideration of some plan for the more extended and thorough education of apprentices in iron and wood-working trades. This question has been met, and in some measure satisfactorily answered by France, Germany and Belgium, by the support of public training schools under government direction. We are apprehensive that such a plan would not work as well in the United States as abroad; yet, unless we provide more efficient measures for the training of artisans than those now relied upon to fill the ranks of skilled workmen, the unpleasant prospect of being excelled in manufacturing industries by foreign nations, confronts us. The conviction is forcing itself upon a large number of those who have given the subject careful, intelligent consideration, that the government ought to do *something* toward educating apprentices, inasmuch as it assists general educational institutions. The State of New York, and we believe, some other States, partly pays for the instruction of a limited number of students in private academies, every year, who declare their intention to become teachers in the schools of the State. Besides this, nearly every State has its normal schools wholly supported by government. Why, we ask, would it not be a wise plan for the State to partly pay for the instruction of a limited number of apprentices, in iron and wood work, in private shops which are well prepared to train apprentices? If bright boys who have no means to pay their way during a course of apprenticeship, were helped so they could complete their course without hindrance, it would be a public benefit. Those who can afford to pay their way, without dependence entirely upon their own efforts, can easily find opportunities to learn a trade. But the great problem is, what to do for those who cannot pay. In very few shops can apprentices obtain enough wages to pay their way—at least, for two or three years. Under proper restrictions, the State might aid a limited number of such youths.

Another Special International Exhibition.

One of the evidences of our national industrial progress is the formation of "The International Cotton Exposition Association," to hold a great international exhibition of cotton, cotton fabrics and cotton machinery, at Atlanta, Ga. The officers of this Association are prominent men, both North and South, the President being Senator Joseph E. Brown, of Georgia. The project seems to be taken hold of with an earnestness and determination that leave scarcely any doubt about its success. No more suitable location could have been selected for holding such an exhibition than Atlanta, one of the most enterprising and progressive cities of the South. The rapidity with which improvements in manufacturing cotton goods have been made in recent years, renders such an exhibition every way desirable. The time for holding it has not been definitely fixed.

Our Letters from Practical Men.

Our "Letters from Practical Men" this week embrace several topics of special interest in machine shops and other industrial establishments. It is hardly necessary to say they will be read with particular interest. A few of the general principles involved in the lubrication of machinery are presented by F. H. Richards, of Troy, N. Y. S. W. Goodyear, of Pittsburgh, Pa., gives expression to some weighty arguments in favor of using adjustable gauges for maintaining standard cylindrical sizes in machine-shop practice. He calls attention very plainly to the disadvantages of fixed gauges where they are depended upon for securing accurate sizes. He shows how thousandths of an inch can be measured just as easily by the use of adjustable gauges as half and quarter inches by rules and calipers, besides doing it more accurately.

The president of the Dixon Crucible Company, of Jersey City, after perusing an article by Wm. J. Williams, in our October 16th issue, reminds the readers of the AMERICAN MACHINIST that plumbago is not mined in a condition of sufficient purity for lubricating purposes, but must be purified and prepared by some process. He explains that the impurities may not be visible to the naked eye. Just how we are to distinguish between the proper and the improper article for lubrication and for other purposes, and how to use it to the best advantage, would be interesting to the mechanical community to know, and as he possesses superior knowledge and experience regarding plumbago, some of our correspondents may, possibly, call upon him for more explicit information.

A few hints about methods of getting a good surface on wrought-iron bearings are thrown out by H. Norton, of Bernardstown, Mass., who closes by suggesting the entire abandonment of such bearings for steel.

W. S. Harris, of Croton Falls, N. Y., explains a way he has found to be very successful for case-hardening set screws and other small articles of iron. H. W. P., of Philadelphia, tells how to make a good machine shop (ground) floor that will be firm and durable by using broken stone, covered by asphalt concrete. In this connection, it may be noted that a prominent member of the British Institution of Civil Engineers recently read a paper, advocating the use of asphalt for the foundations of machinery, especially such as run at high speeds, the asphalt having the quality of absorbing vibrations.

Progress of the World's Fair Enterprise.

The selection of Inwood on the Harlem River as the site of the World's Fair of 1883, seems to give general satisfaction. It is reached directly by land by two elevated railroads, also by the Hudson River, Harlem and New Haven Railroads. But the greatest advantage of access is that it is conveniently reached by steamboats. The territory selected is a level spot of 250 acres, eleven miles from the City Hall. It is at the extreme north end of Manhattan Island, a locality of historical interest by reason of some revolutionary incidents. Active preparations have already been begun, and the financial part will undoubtedly be pushed with such energy as to enlist a strong public spirit. One of the best features of the site is that it *costs nothing*, the owners having offered it free for the purpose.

An Important Legal Decision.

A legal case, of unusual interest to employers and workmen, has recently been decided at Rochester, N. Y. Some weeks since the Johnson Harvester Co., of Brockport, reduced the wages of its moulders, and the men went on a strike, causing the whole establishment to shut down, thus placing over 400 men in a state of enforced idleness. The company tried to drive the moulders into the acceptance of the lower wages, and the moulders, on the other hand, tried to keep the works idle until the company should take them back at old rates. Moulders were hired from other localities to take the strikers' places, but as soon as they arrived, strong expostulations, on the part of the strikers, induced them to withdraw. After a few movements of this kind, the company secured a temporary injunction from Judge Macomber to restrain the strikers from interfering, in any respect, with such new men as the company might employ. The case was brought to trial on motion to make the injunction permanent, resulting in a decision adverse to the company. The judge, in giving his decision, reviewed the case at considerable length. "The moulders," he said, "were at work by the day or piece, and had not contracted services for any stated period. The orderly co-operation of employés to secure an increase of wages, or for the maintenance of such right, is now permitted by chapter 19, of the laws of 1870. The origin of this kind of action was at the time of the substantial enslavement of domestic servants, and went on the theory that they had no freedom of action. He was unwilling to extend the doctrine of recovery for the peaceful enticing of free agents. He holds that there should be no legislation on this subject, beyond such as insured both parties from violence, trespass, etc. Aggregated capital has a tendency to induce combinations of labor to prevent capital from disturbing its relationship to the detriment of labor. "It is," he says, "for such reasons that trades unions were organized, and for such reasons is it, if at all, that their policy can, on principles of political economy, be recognized and sustained. The law of supply and demand should govern the parties. The field open to both parties is wide."

The decision, which is a surprise to a great many people, will form an important precedent in cases of the kind hereafter.

On our third page we present engravings of the new dynamo machine and electric lamps used in the Brush system, which has just been applied to lighting the principal street and a number of prominent buildings of New York City. Quite a number of cities and towns are now lighted by this system, and its public introduction into the metropolis cannot help being received with favor.

Prof. Sweet and Chordal, as will be noticed by their communications in this week's issue, exhibit a notable unanimity of opinion on the shaft-coupling subject. We are almost certain that they have never compared views on the subject.

Government Record of Marine Accidents.

Just how accurately or comprehensively, the record of accidents for the year closing June 30th, 1880, and just published, has been kept by the U. S. Supervising Inspector of steam vessels, we have no present means of knowing, but the figures presented are, to say the least, suggestive from several points of view.

According to the report, out of a total of 4,536 vessels inspected, the total number of lives lost by "accidents," from various causes during the year, was as follows: Explosions, 22; fire, 52; collision, 66; snags, wrecks and sinking, 14; accidental drowning, 25; miscellaneous casualties, 6; total lives lost, 185. The inspector calls attention to the small proportion which this total bears to the total numbers of passengers transported, which latter is claimed to be 220 millions. An average of one life lost out of over one million of passengers transported would seem to be rather reassuring to the timid, though this argument will doubtless be made conveniently light of, by the industrious promoters and agents of our Accidental Insurance Company. When traveling is well understood to be safer than staying at home, the amount of money now spent for accident insurance by the traveling public may be revised to advantage. Query: In the interest of that much dreaded and dimly understood force which the public call *steam*, would it not be well to contrast this record with the probable record that would be spread before us, could we conceive the realized possibility of transporting 220 millions of people in a single year by any other motive power?

It should be noted that a very large proportion of the total number of passengers referred to in the above figures are transported by the ferries of New York City.

To the surviving friends of the 185 persons lost, it will doubtless be a small consolation to know that the accident record is so favorable as here stated, for it may be confidently premised that for every one of the "accidents" alluded to, somebody's carlessness is responsible, could the facts be fully ascertained. In other words, small as the loss of life is computed to be, it might hereafter be reduced.

Systems of Life Insurance.

Speaking of accidents and insurance against them, it needs only a knowledge of the immense sums which the American public annually pay for the privilege of getting disgusted and throwing away their policies in a few years, to lead us to the conclusion that the prevailing system of life insurance in this country is a delusion and a snare.

The strictly mutual or co-operative system ought to be, and we believe is, to be preferred. Why should not machinery men, for example, in any convenient area of country, insure each other?

While we are on this subject, will somebody suggest a reason why lives should not be insured upon the same principle that is now general in accident and fire insurance systems, as insuring by the year instead of "for life," or long terms on the so-called endowment plan?

This would tend to do away with the plausible necessity for heaping up immense "assets" for the benefit of others than the insured.

It would also tend to induce men to insure of their own accord when they felt the need of it, and would enable them to do without life insurance when circumstances (as often happens to many men) should render it unnecessary.

Doubtless a table of rates varying with age would have to be used in computing rates, but this could as readily be done as under any existing system. Would it not be as well, on the whole, for the great American public to get more and better life insurance, and to pay less for it?

Literary Notes.

STEAM BOILERS, THEIR DESIGN, CONSTRUCTION, AND MANAGEMENT.—By Wm. H. Shock, Engineer in Chief U. S. N., Chief of Bureau of Steam Engineering, United States Navy. Quarto half morocco, 475 pp., 36 plates; price, $15.00. D. Van Nostrand, 23 Murray street, New York.

This book, although describing the different classes boilers and the materials used in their construction, is particularly a treatise upon marine boilers. The author begins this work by describing the materials used in the manufacture of steam boilers in the early days of steam engineering as applied to marine purposes. The practical objections to the different substances used are given also those which were adopted in their stead. An analysis of the different kinds of fuel used forms an important part of the book, and is followed by a chapter on combustion. The subject of transmission of heat and evaporation is treated in a plain, practical way, and is rendered more valuable by the addition of tables. The value of each material for the manufacture of boilers is fully explained, and illustrated by tests of each, showing sizes, shapes and manner of making the tests. The author describes and illustrates the principles of the strength of boilers of different styles, giving the designs, drawings and specifications. In reading the chapter on laying off the sheets, flanging, riveting and welding, the scientific and practical engineer will be equally benefited. We find here recorded tests made of different kinds of riveted joints, which are of more practical value and more comprehensive than any that have come to our knowledge. In describing the welding of plates the author gives the most approved and modern way. The subjects of shell furnaces and back connections, as well as stays and braces, giving the proper attention and directions given for their application and inspection. Flues and tubes are next considered, followed by uptake chimney steam jets and fan-blowers, showing their proper relations to each other. Boiler mountings and attachments, too often overlooked, are set forth in a manner which is calculated to awaken a deeper interest in the subject. In testing boilers the details are described as inflicting as little injury as possible upon the boiler, after which the reader is instructed in the management of boilers so as to prevent the deterioration of the same, explaining causes and the effects. Experimental boiler explosions are described, giving the modern ideas of causes and prevention of such disasters. The plates are well executed, the printing neat and clear, and the work as a whole, certainly, is very creditable to the author who has successfully overcome all the obstacles which are usually encountered in the preparation of so exhaustive and valuable a work. We understand that this treatise is to be used as a text-book at the U. S. Naval Academy.

QUESTIONS & ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common sense methods.

(1) Galvanizer, Akron, O., writes: I have been trying to galvanize gray iron castings and cannot make them take without dipping four or five times. I clean them in a solution of sulphuric acid one part, and water eight parts. After cleaning I wash them thoroughly in water, and dip them in a solution of muriatic acid and zinc. I also use sal-ammoniac, when I dip the castings in the zinc. Can you tell me where the trouble is? *A.*—There are many conditions which would tend to produce the results obtained by you, viz: The metal may not be right, particularly when a cast iron pot is used for melting, and when the flux is not properly used the metal will soon become dross. A proper care is not always observed in cleaning the castings. They should not be left in the acid too long, and before placing in this bath they should be perfectly freed from sand, and in many cases it is necessary to scrape them. When placed in the bath of zinc they should be allowed to remain there until they attain the same temperature as the zinc. This is frequently the cause of failure in galvanism. A certain amount of practical experience is indispensible to success. We think that you have not taken sufficient time in the details of your process and also that the castings were not properly cleaned before dipping.

(2) M. D. M., Lawrence, Kan., asks: 1. Is there a difference of pressure between the boiler and the piston when the piston is making four hundred feet per minute in the ordinary engine? *A.*—Yes, and that difference is governed by the length and size of the steam passages, also the operation of the valves and the speed of the piston. 2. If so about what per cent. less on the piston? *A.*—This can only be ascertained by the application of an "indicator" to the cylinder and take some cards. There is such a variety of engines that it is impossible to give an average. 3. Does the difference vary with different engines? *A.*—Yes, the difference varying in most engines having an automatic cut off. 4. Does the difference vary with a change of motion other conditions remaining the same? *A.*—Yes. 5. I fail to find anything definite on these points in any treatise on the steam engine I have been able to find. *A.*—You should procure and study articles on Engineering Popularized by William Lee Church, which have been published in the AMERICAN MACHINIST for January, February, March, April, May, June 28, July 19, August 16, 1879. The papers referred to will enlighten you on the subject.

(3) J. W., Martin's Ferry, Ohio, writes: I would like you to answer the following questions: 1. What should be the minimum heating surface of an 8 HP. boiler of the locomotive or internal fire-box plan, and what would be the evaporation driving an engine 5½"x12" cylinder, speed 200 revolutions per minute, cutting off at ⅝ of the stroke? *A.*—Your questions are of such a nature that they can hardly be reduced to anything more than general principles, on account of their varying conditions. In common practice the amount of heating surface allowed is 15 feet per horse power. To get at the subject in a proper manner, we must assume that a certain number of pounds of water per HP. are evaporated per hour to get the grate surface. The usual allowance for ordinary slide valve engines is one cubic foot, or 62.4 pounds. The rule, then, will be, divide the number of pounds of water evaporated per hour, from 212° temperature, by 80, which will give the area in square feet of the grate surface. The next step is to find, approximately, the amount of coal burned per HP. per hour. The usual allowance, in practice, for horizontal tubular boilers for bituminous coal, is 18 pounds per hour, and 14 pounds for anthracite, with a natural draught. With a forced draught these figures may be doubled. Care should be observed in firing with a forced draught, as it is accompanied by a waste of fuel. The construction and condition of steam boilers and steam generating apparatus is so different, that it is dangerous to give any but very general rules, based on extended practice, of their efficiency, even for a specific class of apparatus for the generation of steam. In general, a good boiler and coal-burning apparatus in good condition, with good coal, should evaporate eight pounds of water with one pound of coal, and this, in a good cut-off engine, should give an efficiency of one-eighth of a HP. Your engine should develop about 8 HP. 2. Can such an engine be balanced so as to overcome the surging back and forth? If so, how? *A.*—Your engine can only be balanced to run at a certain known speed. A good practical way is to place a collar upon the shaft, with a projection upon one side. This projection should be so made that a weight may be attached to it, being adjustable and held by means of a set screw. By adjusting this weight to and from the center of the shaft, the position may soon be determined by running the engine up to speed, and trying the weight in different positions. After the engine has been made to run steady, a permanent weight may be made when desired, but it is not necessary. 3. How can the weight of the reciprocal parts be determined? *A.*—By weighing the piston and rod, cross head, connecting rod and pump plunger, or any other part attached to the cross head or reciprocating part of the engine. 4. How can I estimate the weight of the fly-wheel? *A.*—You do not state the kind of work to be done by your engine, or the diameter necessary, therefore we cannot give you a precise answer. We would add, however, that the fly-wheels upon small engines, at the present day, are proportioned by an application of nine-tenths common sense and good judgment.

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Thomas D. Stetson, Patent Solicitor and Expert in Patent Cases, No. 23 Murray Street, New York.

See Christiana Machine Co.'s adver., on page 11.

James W. See, Designing and Consulting Engineer, Hamilton, Ohio.

Howard S. Abbot, Attorney at Law and Solicitor of Patents, 617 7th Street, N. W., Washington, D. C. Personal attention given to cases in Patent Office.

J. C. Hoadley, Engineer and Expert, formerly of Lawrence, Mass., has opened an office at 29 High St., cor. Federal, Boston, Mass., where he will be pleased to receive old and new friends.

MANUFACTURES.

The St. Louis, Mo., Type Foundry Company, are obliged to look for better accommodation for their increased business, and propose to build a new shop on the corner of Main and Washington streets.

John Goodin, St. Louis, Mo., has bought a lot on Christy Ave., to put up a new shop. Rush of business forced it.

Simmons' Hardware Company, St. Louis, Mo., sold over $4,000,000 worth of hardware their last fiscal year.

One of our St. Louis, Mo., correspondents writes: "Everyone is busy in St. Louis, Manufacturing is increasing rapidly."

Lyon, Bragg & Hubbard, West Waterville, Me., are making good progress on their new factory and machine shops. The building is 40x70 feet and three stories. Water power will be employed.

A brick extension is being added to the Marine Engine Works, at Chicago.

The new rolling mill of Alan Wood & Co., at Conshohocken, Pa., will start up about the first of the year. It will employ about 200 men.

McKee & Fuller, proprietors of the Lehigh Car, Wheel and Axle Works, at Fullerton, Pa., are erecting a new machine building of brick, which is 50x80 feet in dimensions, three stories in height. When completed, the blacksmith department will be extended into the present machine shop, the building being 140x50 feet.

J. M. Jones & Co., car manufacturers, of Schenectady, N. Y., are erecting an additional building 40x125 feet and two stories high, and are also putting in new machinery.

Frank Grant & Co., a Westfield, Mass., concern, are soon to begin the manufacture of emery wheels at Chester, and will occupy a building 65x35 feet. They expect to employ some five to eight hands.

The Chester, Pa., Oil Company are to make extensive improvements. They have 1,700 feet front on the Delaware river, and there have already been erected upon the land pump, boiler and tool houses, and a large machine shop.

J. B. Williams & Co. are to start a large cutlery works at Naubuc, Conn.

A new company has been organized in Rockford, Ill., to manufacture glucose. They are now putting up the building. Capital of the company is $100,000.

The Rockford, Ill., Co-operative Furniture Company has been organized; capital, $25,000. Each partner takes $500 of the stock. They will commence business at once.

E. P. Allis & Co., Milwaukee, Wis., are running their shop twenty-four hours a day, and can't keep up with their orders.

Daniel C. Stover, Freeport, Ill., has fitted up his new machine shop with good tools for jobbing, and to manufacture some specialties of his own invention.

The Chesapeake and Ohio Railroad Company is adding 12 new stalls to its round house at Huntington, W. Va., more than doubling the present capacity; a new blacksmith shop, 80 by 160 feet, is also to be built at once; the old shop is to used for a boiler shop, and the machine shop is to be extended 75 feet.

A union elevator, with a capacity of 650,000 bushels, is under process of construction for the Chicago, Burlington & Quincy R. R. in East St. Louis, Ill., south of their freight depot. About two-thirds of the foundations are laid, and the work will be finished next week. Smith, Beggs & Rankin, of St. Louis, are making a Corliss engine of eleven hundred horse power, at a cost of $13,000, for the new elevator.

The Amoskeag Manufacturing Company of Manchester, N. H., are enlarging and remodeling their machine shop.

The Philadelphia & Erie Railroad Company are making heavy improvements along the line of their road. They are building a car shop at Renova, 800 feet long, with a wing; and a car shop in Erie, 200 feet long and 80 feet wide.

Bird, Hollingsworth & Co. are rebuilding their large paper mill at Walpole, Mass., destroyed by fire last season. The contract for furnishing all heavy shafting, pulleys and general machinery has been nearly filled by the Whittier Machine Company, Boston. The contract for special paper machinery was awarded to the Boston Machine Company.

The American Tubular Rail M'f'g Co., with offices in the Honore Block, Chicago, says the *Railway Review*, are about to start a manufactory for the construction of a new patent tubular rail. The incorporators of the company are A. McKenny, president; C. H. Horine, vice-president; R. C. Meldrum, treasurer, and Wm. S. Brewster, secretary.

Samuel A. Crozer is erecting a new cotton mill at Chester, Pa.

The Chicago Sugar Refinery Co. are about to erect an immense glucose factory in that city to employ 200 men.

George B. Williams of Taunton, Mass., has workmen engaged in breaking ground for a new structure, the dimensions of which will be 35x50 and three stories. Ii is said to be intended for another tack factory.

The Mason Machine Works of Taunton, Mass., have received orders for eleven of their new locomotives,—engine and tender in one; also 100 looms for the Tremont and Suffolk Mills, of Lowell.

It is said that A. J. Buckstaff will erect a factory at Lincoln, Neb., for the manufacture of paper pails and other goods that are made from straw.

Machinists' and Engineers' Supplies.

NEW YORK, Dec. 16, 1880.

The general state of the supply market continues good and preparations have already commenced for a brisk trade which is expected at the beginning of the new year.

The manufacturers of bolts and nuts held a meeting in this city last week at which the following prices were adopted: Machine Bolts, Bolt Ends, Lag Screws and Skein Screws, discount 60 and 10 per cent. Square and Hexagon Nuts, 7¾ cents off list. Washers 7¼ cents off list.

At a meeting of File manufacturers held in this city, yesterday an attempt was made, we understand, to form an association but was unsuccessful.

Wrought iron pipe continues stiff at the old prices, 65% @ 67½% off regular list. The mills still behind their orders.

A. F. Cushman, Hartford, Conn., has just issued a new illustrated catalogue and price list of 23 pages, describing the different styles of chucks and tools manufactured by him.

The firm of Boyd & Chase, manufacturers of Oil Stones, 107th street and Harlem River, New York, was dissolved on the 6th instant. The business will be continued by George Chase.

Iron and Metal Review.

NEW YORK, December 16, 1880.

The pig iron market remains quiet though firm in tone. Quotations are unchanged as follows: Foundry No. 1, $25. Foundry No. 2, $21.@$22. Gray Forge $20@$21.

No changes are reported in the market for manufactured iron.

Carmichael & Emmens, 130 Cedar St., New York, quote prices of Boiler Makers' Supplies from store as follows:

Flange Iron	5¼
C. H., No. 1, Shell Iron	4¼
C. No. 1 Iron	4
Tank Iron	3¾
Sheet Iron	3½
Angle Iron	3½
Bead Iron	5½
Burden Boiler Rivets	5 1-10

Boiler Tubes at 40 per cent. discount off list.

LUCIUS HART & CO., 8 & 10 Burling Slip, New York, furnish us the following to-day.

Business in metals dull, with fair jobbing demand. Pig Tin, in London, £91, in Singapore $28¼. The sale of Billiton Tin in Batavia realized parity of 21c. per lb. here. Considerably higher than sale in last October. We quote Spot market nominally 24½c. 25c. for Banca Tin; Malacca and Straits 20¾c. to 21c. Billiton and Australian 20½c. to 20¾c.; "Lamb & Flag," 20¼c.; Bar Tin, 22c.; Pig Lead 4¾c. or less, for round lots, market weak. Antimony, 15c to 16c. according to brand, Spelter; 5c. to 5¼c. for Western; 8c. to 8¼c. for "Bertha," pure; Solder, No. 1, 11½c.; "Half and Half, "13½c. Bismuth from $2.50 upwards.

WANTED

Parties desiring a competent man to superintend the erection of engines or machinery, address J. F. Kingsley, Box 777, Owego, Tioga Co., N. Y.

Wanted by the Southwark Foundry and Machine Co., Philadelphia, a number of first-class Fitters on Engine Work.

Wanted.—A first-class man to set up engines, one familiar with the use of Indicator preferred. Address with references, Automatic cut-off Engine, this office.

Wanted—Machinists.—Three strictly first-class Lathe hands, one draughtsman accustomed to Saw Mill machinery. Address D. J. Murray, Wausau, Wis.

Wanted.—A Mechanical Draughtsman; apply by letter to "109" office of the AMERICAN MACHINIST.

Practical machinist, draughtsman and designer; address, stating experience and salary expected, K. M. C. AMERICAN MACHINIST office.

Wanted an assistant draughtsman and to keep in the office. A young man who has some practical knowledge, can make a reasonable elevation and plain figures, can hear of a situation by sending sample of drawing and writing to P. O. Box No. 16, Watsontown, Northumberland Co. Pa.

Wanted.—Live canvassers to sell the Hawes Steam Trap in New York City and State and New Jersey. Prothero & Spencer, 95 and 97 Liberty Street, New York.

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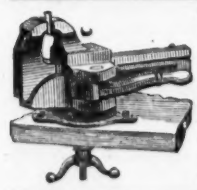

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Messrs. KEARNEY & FOOT, Elizabethport, N. J., May 3rd, 1877.

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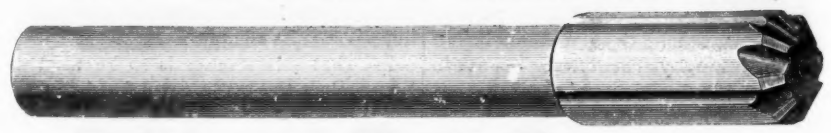

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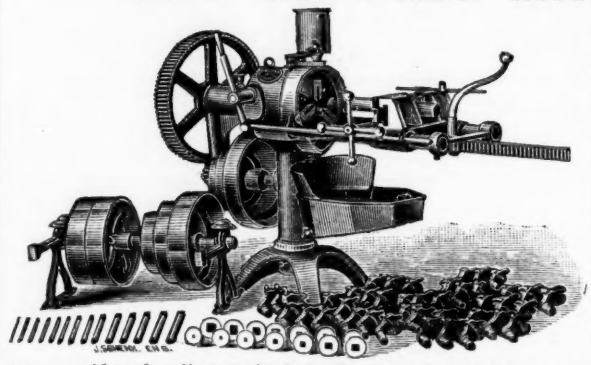

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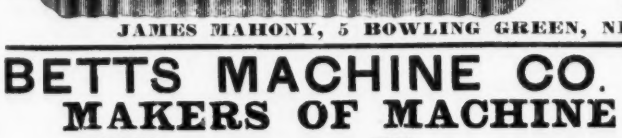

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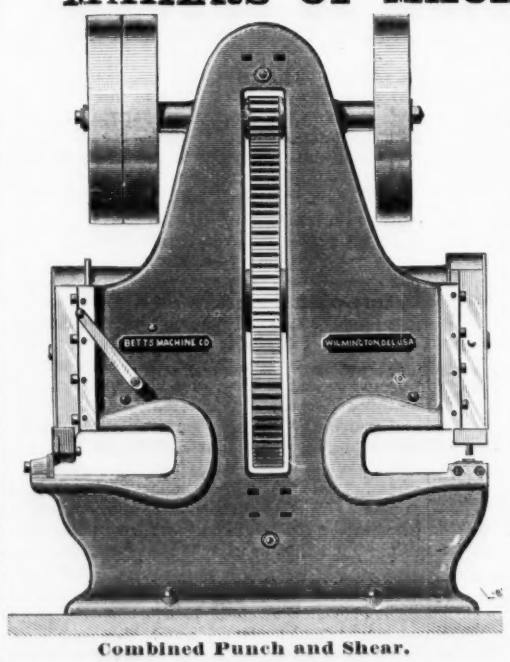

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